

A REVISION OF THE LAKE VICTORIA  
*HAPLOCHROMIS* SPECIES  
(PISCES, CICHLIDAE)

PART VII



BY

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# A REVISION OF THE LAKE VICTORIA *HAPLOCHROMIS* SPECIES

By P. H. GREENWOOD & J. M. GEE

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## INTRODUCTION

MOST of the species described in this paper were collected during experimental and exploratory trawling operations in the northern waters of Lake Victoria.

Trawling has revealed the existence of numerous undescribed, apparently benthic, species living in sublittoral habitats at depths down to more than 200 feet.

Ecological information on these fishes is still very scanty. Many of the species seem to have a wide depth range (for example from 30 to 100 feet, or for species found only at greater depths, from 70 to 200 feet), but few extend into the littoral and immediately sublittoral zones. Others seemingly have a more circumscribed depth range being confined to depths of from 50 to 100 feet.

This supposed restriction to offshore areas is inferred from the absence of "trawl species" in catches made by other fishing gear in the littoral and inshore sublittoral zones. Such reasoning has, of course, certain weaknesses. For instance, compared with a trawl, the nets used to sample the littoral and immediately sublittoral zones are highly size selective and thus might not catch small fishes. However, adult individuals of several "trawl species" are large enough to be caught by seine- and gillnets, yet none of these species has been caught, despite intensive collecting.

Conversely, only one predominantly littoral species, *Haplochromis obesus*, has been caught in deeper water. We have, however, certain reservations about the identity

of these specimens which could be representatives of a deep-water species closely related to *H. obesus* (see appendix, page 63).

The geographical distribution of "trawl species" within the lake is still unknown since all the available collections are from the northern (Uganda) part of Lake Victoria. Even within this area, however, there are indications from some species of interpopulational differences in certain morphological characters. Doubtless our descriptions of the new species will have to be modified when specimens from other areas become available. Nevertheless, we are moderately confident that such additional data will not alter the specific validity of the taxa described below.

We have assumed that most, if not all, of the known "trawl species" live on or near the bottom for at least part of the day: these assumptions are based especially on the nature of the food of those species whose diet is known, and on the other ingested material found in the gut. But, we cannot overrule the possibility of fishes being caught while the net is sinking to the bottom or being hauled to the surface.

The present paper by no means covers all the new species that have been caught in trawling operations. The other species will be described in subsequent papers, where it is also proposed to discuss in more detail the relationships of the "trawl species" to each other and to the inshore species complexes.

*Haplochromis megalops* sp. nov.

(Text-fig. 1)

HOLOTYPE: an adult male 75.0 mm. S.L. (B.M. [N.H.] reg. no. 1968.8.30.57.) from Windy Bay, Napoleon Gulf.

The trivial name refers to the large eye.

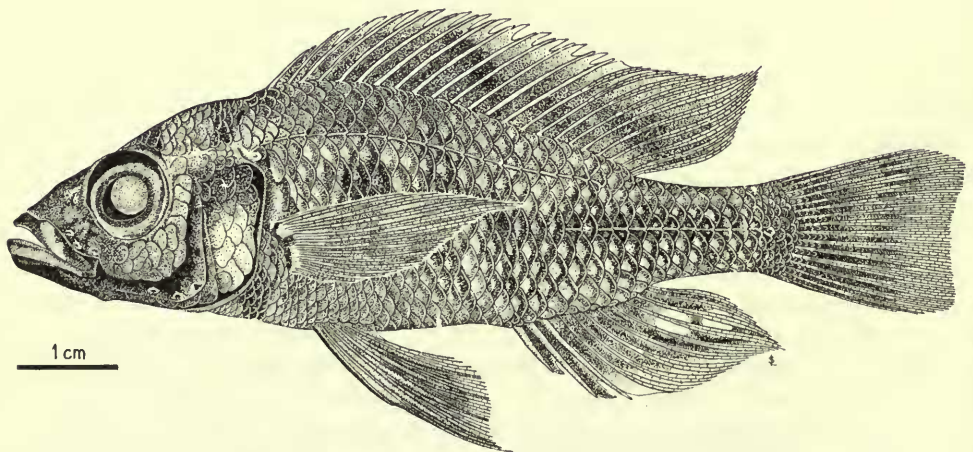


FIG. 1. *Haplochromis megalops*. Holotype. Drawn by Sharon Lesure.



DESCRIPTION: based on 27 specimens (including the holotype), 66.0–81.0 mm. S.L.

Depth of body 30.9–36.3 (mean,  $M = 33.4$ ) % of standard length, length of head 32.0–35.6 ( $M = 33.8$ ) %.

Dorsal head profile straight except for a slight curvature in the nuchal region, and sloping fairly steeply at 30°–40°.

Preorbital depth 11.1–15.4 ( $M = 12.9$ ) % of head length, least interorbital width 22.7–28.0 ( $M = 24.9$ ) %. Snout broader than long (1.1 [mode] to 1.3, rarely 1.4 times), its length 25.0–30.8 ( $M = 27.5$ ) % of head; eye diameter 32.7–41.0 ( $M = 36.4$ ), depth of cheek 17.3–22.6 ( $M = 20.0$ ) %.

Caudal peduncle 15.3–19.2 ( $M = 16.3$ ) % of standard length, 1.2 (rarely)–1.6 (mode 1.4) times as long as deep.

Mouth very slightly oblique; posterior tip of the maxilla reaching a vertical through the anterior part of the eye or, less commonly, to the anterior orbital margin. Jaws equal anteriorly or the lower jaw projecting very slightly, length of lower jaw 39.6–46.0 ( $M = 43.3$ ) % of head, 1.8–2.3 (mode 2.0), rarely 1.7 or 2.4, times as long as broad.

*Gill rakers*: 10–12 (mode 11) on the lower part of the first gill-arch. The lower 2 or 3 rakers are reduced, and are followed by from 1 to 3 relatively slender rakers; the remainder are usually somewhat flattened, with the upper 1 or 2 often anvil-shaped.

*Scales*: ctenoid. Lateral line with 30 (f.3), 31 (f.6), 32 (f.12) or 33 (f.5) scales; cheek with 2 or 3 rows. Five to 6 (mode 5½) scales between the upper lateral line and the dorsal fin origin, 5–7 (mode 6) between the pectoral and pelvic fin bases.

*Fins*. Dorsal with 23 (f.3), 24 (f.17) or 25 (f.6) rays, comprising 14 (f.3), 15 (f.18) or 16 (f.5) spinous and 8 (f.4), 9 (f.17) or 10 (f.5) branched elements. Anal with 11 (f.8), 12 (f.16) or 13 (f.1) rays, comprising 3 spines and 8–10 branched rays. Pectoral 28.7–33.8 ( $M = 30.5$ ) % of standard length. Pelvics with the first ray produced (apparently in both sexes, but only 1 female fish is available). Caudal truncate, scaled on its basal half.

*Teeth*. Except posteriorly in the upper jaw, the *outer* teeth in most specimens are either bicuspid, or an admixture of bi- and weakly bicuspid. The teeth are compressed, relatively stout, and slightly recurved. In some fishes most outer teeth are unicuspid and caniniform, while in other specimens unicuspid occur amongst the more numerous bicuspid; only rarely are all the outer teeth unicuspid. The outer teeth in both jaws of an individual may be similar in form, or there can be relatively more unicuspid present in the lower jaw.

The posterior outer teeth of the upper jaw are usually unicuspid and caniniform, and are often relatively large. In a few specimens, however, these teeth are similar to those occurring laterally in the jaw.

There are 48–60 ( $M = 52$ ) teeth in the outer row of the upper jaw.

The *inner* teeth are generally tricuspid, but weakly so, and in a few fishes are unicuspid. All inner teeth are implanted somewhat obliquely, and are arranged in 2 rows (infrequently in 1 row) in the upper jaw, and in a single row in the lower jaw.

*Osteology.* The syncranium of *H. megalops* is typically that of a structurally generalized *Haplochromis* species, and as such does not depart from the type found in, for example, *H. macrops*, *H. nubilus*, *H. phytophagus* or *H. obliquidens*.

The *neurocranium* has a decurved preorbital profile and has the proportions of a generalized skull type. The openings to the cephalic lateral line canals are, however, somewhat larger than those of the species mentioned above. In contrast, the lateral line system in the dentary of *H. megalops* is not noticeably enlarged.

The lower pharyngeal bone is fine, its dentigerous surface slightly broader than long (1.1–1.2 times). The teeth are slender and cuspidate, and are arranged in 30–36 rows. In most specimens the teeth of the median rows are a little coarser than the others.

*Coloration.* The colours of live males are unknown; females are silvery (darker on the dorsal surfaces), with the dorsal fin hyaline, and the pelvic and anal fins pale yellow.

*Preserved material: Males (adult and sexually active)* brownish grey above the midlateral line, dusky silver below (the amount of silver visible is variable, with in extreme cases most of the ventral body half solid black save for a fine silvery sheen on the lateral aspects of the belly). A few fishes show traces of about 4 dark blotches arranged along the midlateral line of the flanks.

The snout is almost entirely black, as is the preorbital region, the lower jaw and the ventral aspects of the preoperculum; in some specimens the posterior opercular margin (otherwise silver) has a broad black margin. Two intensely black bars cross the snout, but these are only faintly discernible on the general dusky coloration of this region. A medially interrupted occipital band originates near the dorso-posterior margin of the orbit, and the nuchal region is crossed by a dark band (of variable distinctness) which originates near the opercular-preopercular junction.

Dorsal fin dusky, as are the caudal and anal fins, the latter being of variable intensity, almost black in some specimens. The anal ocelli are small, and dead white. The pelvic fins are black.

The single female available is extensively stained by rust from the metal container in which it was preserved. Thus, nothing can be said about its preserved coloration.

*Ecology. Habitat.* At present, the species is known from only 2 localities, one a small bay in the Napoleon Gulf near Jinja, the other in Pilkington Bay. In both places the habitat is sheltered, the water from 10–30 feet deep, and the substrate of mud or of interposed mud and sand patches.

*Food.* Seven of the 25 guts examined were empty. In the remainder, the predominant ingested material is macerated dipterous (?chironomid) larvae, together with small quantities of bottom mud. Chironomid pupae are also present in 8 stomachs.

*Breeding.* The single female examined (74 mm. S.L.) is in an advanced stage of oogenesis; both ovaries are equally developed. All the males (66–81 mm. S.L.) are adult.

*Diagnosis and affinities.* *Haplochromis megalops* closely resembles another new species, *H. piceatus* (see p. 7); preserved specimens of the 2 species are readily confused on superficial examination. However, *H. megalops* has a larger eye (32.7–41.0, mean 36.4% of head, cf. 29.0–34.0, mean 32.3% in *H. piceatus*), and a much

shallower preorbital (11.1–15.4, mean 12.9% of head, cf. 13.6–17.8, mean 15.3%). There are other, but less trenchant differences, including dental characters (cf. p. 5 and p. 8).

Superficially, *H. megalops* resembles *H. cinereus*, but is distinguished from that species by its more numerous gill rakers (10–12, mode 11, cf. 7–9, mode 7), shallower preorbital (11.1–15.4, mean 12.9% head, cf. 15.0–18.0, mean 16.4%), larger eye (32.7–41.0, mean 36.4% head, cf. 26.2–32.0, mean 28.7%), longer lower jaw (39.6–46.0, mean 43.3% head, cf. 34.6–41.3, mean 37.7%) and by differences in the oral and pharyngeal dentition (see Greenwood, 1960, p. 240).

From *H. macrops*, another large-eyed species of the generalized *Haplochromis* species group (or groups), *H. megalops* is distinguished by its higher gill raker count (10–12, mode 11, cf. 8–11, mode 9) and its longer lower jaw (39.6–46.0, mean 43.3% head, cf. 38.0–42.5, mean 39.5%); the coloration of preserved specimens also differs (see Greenwood *op. cit.*, p. 236).

*Haplochromis megalops* is structurally and trophically a generalized species, and thus it is difficult to suggest its phyletic affinities in any more precise terms. Apart from *H. piceatus*, the species which it most closely resembles are *H. macrops*, and *H. cinereus* (see Greenwood, 1960, pp. 236–239, and 239–242).

#### STUDY MATERIAL AND DISTRIBUTION RECORDS

Museum and Reg. No.	Locality	Collector
	UGANDA	
B.M. (N.H.) 1968.8.30.57 (Holotype)	Windy Bay, Napoleon Gulf . . . . .	E.A.F.F.R.O.
B.M. (N.H.) 1968.8.30.58–73	Windy Bay . . . . .	E.A.F.F.R.O.
B.M. (N.H.) 1968.8.30.74–88	Pilkington Bay . . . . .	E.A.F.F.R.O.

#### *Haplochromis piceatus* sp. nov.

(Text-figs 2–4)

**HOLOTYPE:** an adult male 88.0 mm. S.L. (B.M. [N.H.] reg. no. 1968.8.30.39) from the Napoleon Gulf opposite Jinja Prison.

Named with reference to the coloration of preserved specimens (from the Latin, meaning smeared with pitch).

**DESCRIPTION:** based on 16 specimens (including the holotype) 67–90 mm. S.L.

Depth of body 32.0–35.3 ( $M = 33.3$ ) % of standard length, length of head 32.8–35.5 ( $M = 34.1$ ) %.

Dorsal head profile straight, except for slight curvature in the nuchal region, sloping at an angle of 35°–40°.

Preorbital depth 13.6–17.8 ( $M = 15.3$ ) % of head, least interorbital width 21.8–25.0 ( $M = 23.6$ ) %. Snout as long as broad or very slightly broader than long (1.1 times), its length 27.2–32.2 ( $M = 28.3$ ) % of head; eye diameter 29.0–34.0 ( $M = 32.3$ ), cheek depth 16.7–21.0 ( $M = 18.9$ ) %.

Caudal peduncle 17.3–20.9 ( $M = 19.1$ ) % of standard length, 1.6–2.0 (modal range 1.6–1.8) times as long as deep.



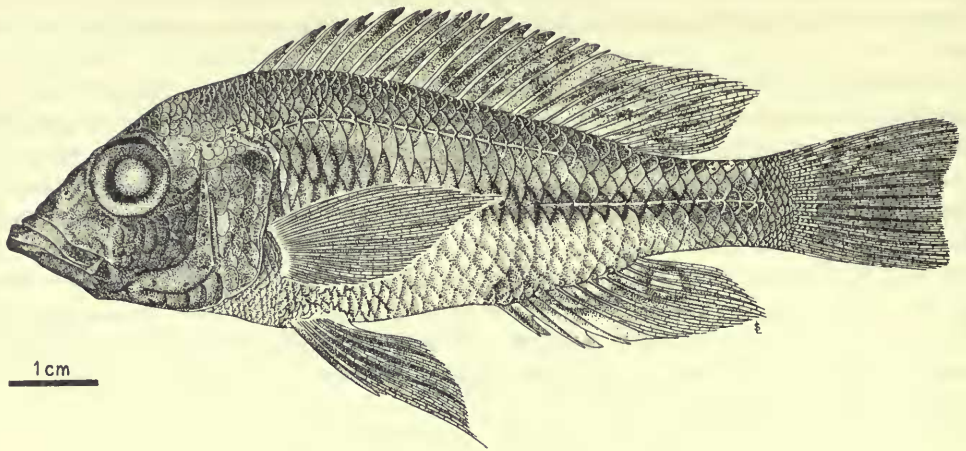


FIG. 2. *Haplochromis piceatus*. Holotype. Drawn by Sharon Lesure.

Mouth slightly oblique, the jaws equal anteriorly or, more commonly, the lower projecting slightly; length of lower jaw 41.8–45.0 ( $M = 43.5$ ) % of head, 2.0 (mode)–2.6 times its breadth (in one exceptional specimen 2.8 times). Posterior tip of the maxilla reaching a vertical through the anterior part of the eye or only as far as the anterior orbital margin.

*Gill rakers*: 12 (mode) or 13, rarely 11 or 15, on the lower part of the first gill arch. The lower 2–5 rakers reduced, the remainder of varied form (even in one individual), usually short, or slender, or flattened and with the uppermost raker anvil-shaped in outline; some lower rakers may also be anvil-shaped or lobed.

*Scales*: ctenoid. Lateral line with 32 (f.7), 33 (f.7) or 34 (f.2) scales, cheek with 2 or 3 rows. Five to 6 scales between the dorsal fin origin and the upper lateral line, 5–6 (mode) between the pectoral and pelvic fin bases.

*Fins*. Dorsal with 23 (f.1), 24 (f.11) or 25 (f.4) rays, comprising 14 (f.2) or 15 (f.14) spinous and 9 (f.10) or 10 (f.6) branched elements. Anal with 11 (f.11) or 12 (f.5) rays, comprising 3 spines and 8 or 9 branched rays. Pectoral 27.0–32.3 ( $M = 29.6$ ) % of standard length. Pelvics with the first ray produced in both sexes, but proportionately longer in males. Caudal truncate, scaled on its proximal half.

*Teeth*. The *outer teeth* (Text-fig. 3) situated posteriorly in the upper jaw of most specimens are unicuspid or tricuspid, those placed posterolaterally are tricuspid; in a few specimens these teeth are not, however, differentiated from the other outer teeth. The posterior teeth are deeply embedded in the gum tissue and are difficult to expose (*cf.* the situation in *H. megalops* where these teeth are unicuspid and readily exposed).

The anterolateral and anterior teeth in the upper jaw, and all outer teeth in the lower jaw, are slender, compressed and unequally bicuspid, with the major cusp produced and slender, and the minor cusp short but clearly demarcated.

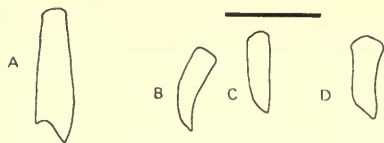


FIG. 3. *Haplochromis piceatus*. Jaw teeth. A, C and D in anterior view, B in lateral view. A: an anterior upper jaw tooth from a small individual (67 mm. S.L.); C and D: posterior upper teeth from a larger fish (85 mm. S.L.). Scale equals 0.5 mm. for A, 1 mm. for B-D.

There are 54-74 ( $M = 64$ ) outer teeth in the upper jaw. The *inner* teeth are tricuspid and generally implanted somewhat obliquely; there are 2 (rarely 3) series in the upper jaw, and 1 or 2 in the lower.

*Osteology.* The syncranium of *H. piceatus* is indistinguishable from that of *H. megalops* (see p. 6); that is, it is of the generalized type.

The *lower pharyngeal bone* (Text-fig. 4) is fine, with its dentigerous surface slightly broader than long, and carries 36-40 rows of slender, cuspidate teeth.

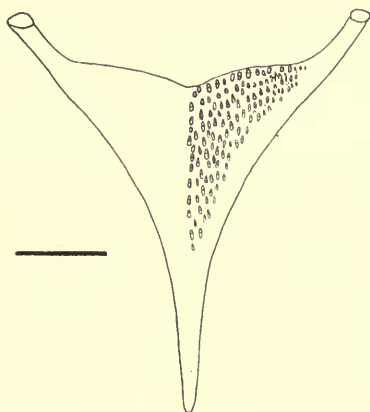


FIG. 4. *Haplochromis piceatus*. Lower pharyngeal bone; teeth indicated on left side. Scale equals 2 mm.

*Coloration.* The colours of live fishes are unknown. *Preserved material.* Males (adult and sexually active), are almost indistinguishable from males of *H. megalops* but differ slightly in that the demarcation between the lighter upper surfaces and the darker flanks is less obvious, the general coloration being greyer. Also, in *H. piceatus* there are no signs of midlateral dark blotches.

*Females* are an almost uniform silvery-yellow, but darker dorsally; there is a very faint indication of a narrow midlateral stripe on the posterior third of the body, terminating at the base of the caudal fin. The dorsal and caudal fins are greyish, the latter weakly maculate on its upper half, and somewhat darker near the base. The anal and pelvic fins are hyaline.

*Ecology. Habitat.* The material on which this description is based came from a trawl haul in water 45–60 feet deep, over a mud bottom, in the relatively sheltered Napoleon Gulf.

*Food.* Four of the 14 guts examined were empty, and the remainder contained very little ingested material. Bottom mud and dipterous pupae (probably Chironomidae) were identified.

*Breeding.* All 16 specimens (67–90 mm. S.L.) are adult. One female has a few larvae in the buccal cavity, thus suggesting that the species is a mouth brooder. Three of the 4 females known have the right ovary, noticeably larger than the left; in the fourth individual (probably at an early stage of oogenesis) the ovaries are of almost equal size.

*Diagnosis and affinities.* *Haplochromis piceatus* is very similar to *H. megalops*; characters distinguishing the 2 species are given on p. 6. The principal dental differences lie in the presence of some tricuspid teeth posterolaterally in the upper jaw of most *H. piceatus* individuals, and in the absence of caniniform unicuspid anteriorly and anterolaterally in the outer tooth row of all individuals. The tendency for the posterior upper teeth of *H. piceatus* to be deeply embedded is another difference between the species.

*Haplochromis piceatus* also resembles *H. cinereus* and *H. macrops* (see Greenwood, 1960, pp. 236–239, and 239–242); it is distinguished from both species principally by its higher gill raker count and longer lower jaw. In other morphometric characters, however, *H. piceatus* approaches these species more closely than does *H. megalops*.

Remarks on the phyletic position of *H. megalops* (see p. 7) apply equally to *H. piceatus*.

#### STUDY MATERIAL AND DISTRIBUTION RECORDS

Museum and Reg. No.	Locality	Collector
	UGANDA	
B.M. (N.H.) 1968.8.30.39 (Holotype)	Napoleon Gulf, nr. Jinja prison .	E.A.F.F.R.O.
B.M. (N.H.) 1968.8.30.40–56	Napoleon Gulf, nr. Jinja prison .	E.A.F.F.R.O.

#### *Haplochromis paropijs* sp. nov.

(Text-figs 5–7)

**HOLOTYPE:** an adult male 69.0 mm. S.L. (B.M. [N.H.] reg. no. 1968.8.30.89) from near Bulago island.

The trivial name (from the Greek for “eye shade”) refers to the prominent lachrymal stripe.

**DESCRIPTION:** based on 34 specimens (including the holotype) 63.0–87.0 mm. S.L.

Depth of body 35.0–40.3 ( $M = 37.4$ ) % of standard length, length of head 31.5–35.8 ( $M = 34.0$ ) %.

Dorsal head profile gently curved (rarely straight), sloping steeply at 40°–45°.

Preorbital depth 13.6–17.4 ( $M = 15.6$ ) % of head, least interorbital width 18.3–28.0 ( $M = 23.1$ ) %. Snout 1.1–1.5 (mode 1.2) times as broad as long, its length



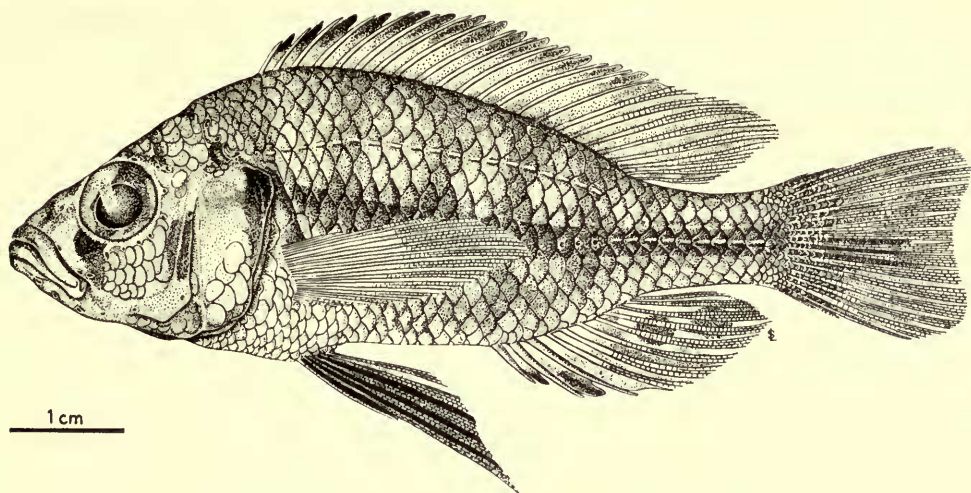


FIG. 5. *Haplochromis paropiuis*. Holotype. Drawn by Sharon Lesure.

25.0–31.9 ( $M = 29.1$ ) % of head; eye diameter 28.0–34.8 ( $M = 31.9$ ), depth of cheek 18.1–24.2 ( $M = 21.3$ ) %.

Caudal peduncle 15.6–20.6 ( $M = 18.8$ ) % of standard length, 1.3 (rare) to 1.9 (mode 1.6) times as long as deep.

Mouth horizontal (the usual condition) to slightly oblique (*ca* 15°); jaws equal anteriorly. Lower jaw 39.5–45.5 ( $M = 41.2$ ) % of head, 1.5–1.9 (modal range 1.5–1.6) times as long as broad; a weak mental protuberance is visible in many specimens.

Posterior tip of the maxilla reaching a vertical through the anterior part of the eye or somewhat posterior to that point (rarely only reaching a vertical through the anterior orbital margin).

*Gill rakers*: 8–10 (mode 9), the lower 1–3 rakers reduced, the upper 2–4 flattened and club-like, branched or anvil-shaped; other rakers of various shapes, from short and stout to relatively slender.

*Scales*: ctenoid; lateral line with 30 (f.1), 31 (f.13), 32 (f.13) or 33 (f.3), cheek with 3 (rarely 4) rows. Five to 7 (mode 6) scales between the upper lateral line and the dorsal fin origin, 5–7 (mode 6) between the pectoral and pelvic fin bases.

*Fins*. Dorsal with 23 (f.8), 24 (f.23) or 25 (f.2) rays, comprising 15 (f.27) or 16 (f.6) spinous and 8 (f.12) or 9 (f.21) branched elements. Anal with 11 (f.23) or 12 (f.9) rays, comprising 3 spines and 8 or 9 rays. Pectoral fin 27.9–34.7 ( $M = 31.7$ ) % of standard length. Caudal truncate scaled on its proximal half. Pelvics with the first ray produced in both sexes, but relatively longer in adult males.

*Teeth*. Except posteriorly, the *outer* teeth in *both* jaws are relatively stout and bicuspid (Text-fig. 6A), with compressed and slightly expanded crowns. Posteriorly and posterolaterally in the upper jaw there are, usually, 2 to 5 enlarged and near caniniform unicuspid teeth, preceded by a variable number of compressed tricuspid.

In some fishes only the tricuspid are present and in a few others the posterior teeth are identical with those situated anteriorly and laterally.

There are 56-74 ( $M = 62$ ) outer teeth in the upper jaw.

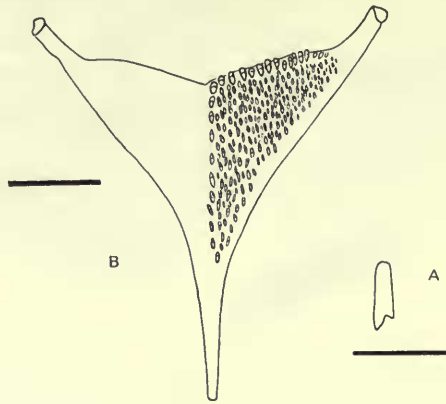


FIG. 6. *Haplochromis paropioides*. A: Upper jaw tooth (anterior view). B: Lower pharyngeal bone. Scale equals 1 mm. for A, 2 mm. for B.

*Inner* teeth are tricuspid, compressed, and arranged in 2 or 3 (rarely 4) rows in the upper jaw and 2 (less frequently 1 or 3) rows in the lower.

*Osteology.* The neurocranium of *H. paropioides* is typically that of the generalized *Haplochromis* type (as seen, for example, in such species as *H. nubilus*, *H. macrops* and *H. brownae*, etc.) with a gently curved preorbital dorsal profile, and relatively

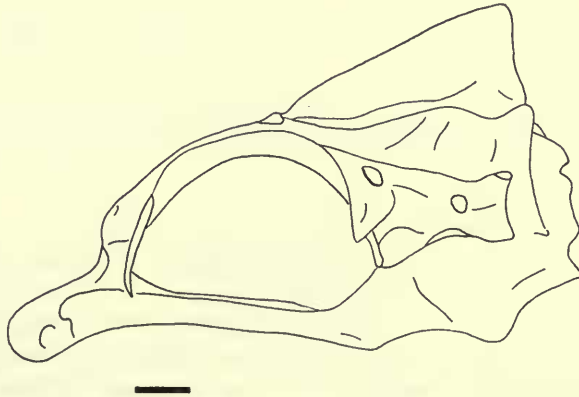


FIG. 7. *Haplochromis paropioides*. Neurocranium; left lateral view. Scale equals 2 mm.

broad in the otic and interorbital regions (Text-fig. 7). The lateral line tubes and pores are not noticeably hypertrophied.

The *dentary* and *premaxilla* are also of the generalized type, although the dentary is more elongate and has slightly enlarged lateral line tubes. The lateral line tubules on the *preorbital* are also somewhat hypertrophied.

The *lower pharyngeal bone* is fine, its triangular dentigerous surface slightly broader (1.1-1.2 times) than long (Text-fig. 6B). The teeth are slender, cuspidate and fairly densely arranged in 38-46 rows, the total impression being that of a dental "felt". In some specimens, teeth in the median rows are slightly coarser than the lateral teeth.

*Coloration in life. Adult, sexually active males:* ground colour of body greenish, as are the snout and lips (the lower sometimes blueish); the belly is silvery. Dorsal surface of the head and body, anterior part of the belly, the opercular region and the branchiostegal membrane red (deepest red dorsally and often on the anterior ventral surfaces, otherwise orange-red). There is a pronounced, dark lachrymal stripe, a fainter transverse bar across the snout and often traces of 3 or 4 faint vertical bars on the flanks; in many individuals a faint dark midlateral longitudinal band is visible.

Dorsal fin dark green proximally, the distal part either with an overall red flush or the red pigment aggregated into spots and streaks on the soft part of the fin. Caudal green proximally, hyaline or flushed with red distally. Anal fin hyaline to white, sometimes with a dusky base; ocelli yolk-yellow. Pectoral fins in some individuals greenish, otherwise hyaline. Pelvics black.

*Quiescent males* are generally similar in coloration to active fishes, but the red body and head colours are much fainter, and the pelvics are dusky.

*Females* are dark grey (with faintly greenish undertones) dorsally, shading to silver on the flanks and belly below a distinct but interrupted dark midlateral stripe. The dorsal fin often has a red flush over the soft part, but the spinous part is hyaline. The anal fin in yellow; all other fins are hyaline.

*Preserved material. Males:* ground colour light brown, shading to silvery-white on the chest and belly; the flank scales in sexually active fishes have broad, dark margins. In most fishes a wide, dark midlateral band runs from the posterior opercular margin to the caudal origin; this band is sometimes broken, and it may even be entirely absent. When absent it is replaced by 5 fairly distinct vertical bars on the flanks; each bar tapers dorsally and ventrally, and none reaches the body outline. Faint to fairly distinct indications of these bars are sometimes discernible in fishes with a well-developed midlateral band.

A distinct, vertical lachrymal band runs from the orbit to immediately behind the posterior tip of the maxilla; it is always visible although of very variable intensity. In some specimens another short vertical bar is present along the vertical limb of the preoperculum. Two parallel transverse bars cross the snout, and a third, medially interrupted and broader bar crosses the occiput from orbit to orbit. This band may appear as a dorsal continuation of the lachrymal stripe.

Dorsal fin hyaline, with dusky lappets, sometimes with dark blotches between the soft rays and at the bases of the spines. Caudal hyaline, but with some darkening of the membrane between the central rays. Anal hyaline to greyish, the ocelli usually greyish-white but sometimes dead-white. Pelvic fins black.

*Females* have a preserved coloration very like that of males (including dark dorsal lappets and a dark base to the dorsal fin), but the ventral surfaces of the body are silvery white, the flank scales are without dark margins, and the cephalic markings are much less intense (or even absent).



*Ecology. Habitat.* *Haplochromis paropius* has been caught in several areas of northern Lake Victoria, but always over a mud substrate, in water 50–100 feet deep, and in off-shore regions.

*Food.* The intestine is long and coiled, the stomach large and distensible, thus suggesting a vegetarian diet. The contents of 20 guts were examined, and seem to confirm this supposition. All contain large quantities of blue-green algae and diatoms, and smaller amounts of other plant material. Eight of these guts contain, in addition, fragmentary remains of larval Diptera (probably chironomids).

Of the plant material, only the diatoms show any appreciable signs of digestion; the blue-green algae are apparently undigested.

*Breeding.* All the specimens examined (63–87 mm. S.L.) are adult.

*Diagnosis and affinities.* Structurally, *H. paropius* is a generalized species in all respects except for the long gut which is a specialization associated with essentially vegetarian feeding habits.

The coloration of adult males seems to distinguish *H. paropius* from most of the other generalized *Haplochromis* species described so far (and including those with vegetarian diets). Exceptions to this statement are *H. erythrocephalus* and *H. cinctus*, both new species described in this paper (see pp. 19 and 15 respectively).

*Haplochromis erythrocephalus* is distinguished by several characters (including details of coloration) and *H. cinctus* principally by colour differences; *H. paropius* is compared with these species on pp. 23 and 18. The resemblance between *H. cinctus* and *H. paropius* is very close indeed, but because the differences involve male coloration we attach great importance to them, especially since the species are sympatric. On anatomical grounds, *H. cinctus* and *H. paropius* would seem to qualify as sibling species.

Superficially, *H. paropius* resembles *H. lacrimosus* (see Greenwood, 1960). Unfortunately the live coloration of adult male *H. lacrimosus* is unknown, but there are certain similarities in the preserved coloration of the two species. However, there are also several differences (*cf.* p. 13 above with p. 231 in Greenwood *op. cit.*) and it seems likely that the differences in live colours may be fairly marked. The principal anatomical characters distinguishing the species are the longer lower jaw of *H. paropius* (39.5–45.5,  $M = 41.2\%$  head, *cf.* 31.4–41.3,  $M = 37.1\%$  in *H. lacrimosus*), the long, coiled gut, and the larger number of outer teeth in the upper jaw (56–74,  $M = 62$ , *cf.* 40–60,  $M = 50$  for *H. lacrimosus*).

Another species bearing a superficial resemblance to *H. paropius* is *H. melanopus* Regan, 1922. This species is very poorly known and has not yet been revised. It is represented only by the 3 syntypes on which Regan based his description (Regan, *op. cit.*, fig. 1). *Haplochromis melanopus* differs from *H. paropius* in having more gill rakers on the lower part of the first arch (11 or 12, *cf.* 8–10, mode 9) and a much shorter lower jaw (31.0–32.6% of head, *cf.* 39.5–45.5,  $M = 41.2\%$ ). Until more is known about *H. melanopus* the comparison cannot be carried further.

From other generalized species with an essentially bicuspid outer dentition, *H. paropius* is distinguished by its coloration, its longer gut, and by various combinations of morphometric characters. For accounts of those species see Greenwood, 1960, and pp. 4–10 of this paper.

Certain other deeper water species resemble *H. paropius* anatomically and in some cases, in their coloration as well (for example, *H. cinctus*, see p. 17). We are studying 3 such species at present but cannot yet describe them in full detail. However, from the information we have it is clear that *H. paropius* is distinct.

*Haplochromis paropius* is derived from the same stem as the other anatomically generalized *Haplochromis* species in Lake Victoria; for the moment it is not possible to suggest any more precise relationships. Despite similarities in male coloration it seems unlikely that *H. paropius* is closely related to *H. erythrocephalus*, which apparently belongs to a different lineage within the complex of generalized species (see p. 23).

#### Notes on three specimens from near Mwama island

Three fishes (64.0, 65.5 and 69.0 mm. S.L.; all adult and sexually active males) appear to be very atypical members of this species. The specimens came from a single trawl haul made at depths ranging from 70–200 feet, over both hard (rock and sand) and soft mud substrates. The trawl was shot in a bay on the south side of Mwama island and hauled at a place some distance off-shore in the open lake.

In general facies the 3 fishes closely resemble other specimens of *H. paropius*, but in 2 specimens the eye is larger (36.4 and 39.1% of head) and in the third the eye diameter is in the upper range known for *H. paropius* (34.8%). All 3 specimens also differ somewhat in coloration, viz., the dorsal head colour is lighter red (i.e. more orange than red) and there is no trace of red pigment on the anterior chest region or on the belly (these regions being white). Finally, the branchiostegal membrane is white and not black as in other *H. paropius* males.

With only 3 specimens available we cannot evaluate the significance of these differences. But, judging from our knowledge of other species related to *H. paropius* (including several as yet undescribed species) the 3 Mwama fishes could well represent yet another species in the "*paropius*" complex.

#### STUDY MATERIAL AND DISTRIBUTION RECORDS

Museum and Reg. No.	Locality	Collector
	UGANDA	
B.M. (N.H.) 1968.8.30.89 (Holotype)	Near Bulago isl. (80–90 feet)	E.A.F.F.R.O.
B.M. (N.H.) 1968.8.30.90–117	S.W. and N.E. of Bulago isl. (55–75 feet)	E.A.F.F.R.O.
B.M. (N.H.) 1968.8.30.118–123	Near Bulago isl. (80–90 feet)	E.A.F.F.R.O.
B.M. (N.H.) 1968.8.30.124–126	Near Mwama isl. (70–200 feet)	E.A.F.F.R.O.

#### *Haplochromis cinctus* sp. nov.

(Text-fig. 8)

**HOLOTYPE:** an adult male 84.0 mm. S.L. (B.M. [N.H.] reg. no. 1968.8.30.13) from a trawl haul made in water 70–200 feet deep, near Mwama island.

The trivial name (from the Latin for "girded") refers to the characteristic banding seen in males.

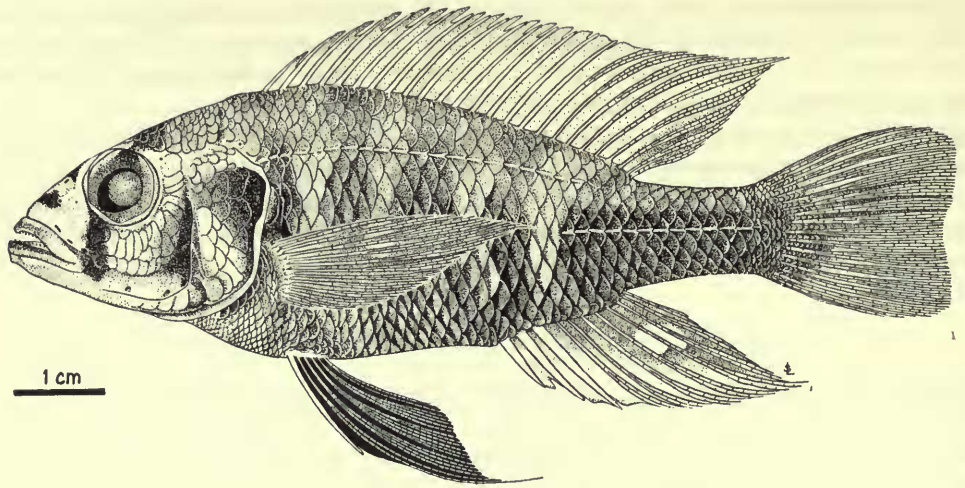


FIG. 8. *Haplochromis cinctus*. Holotype. Drawn by Sharon Lesure.

DESCRIPTION: based on 6 specimens 76.0–87.5 mm. S.L. The principal morphometric ratios are given below:

S.L.	D.†	H.†	Po. %	Io. %	Snt. %	Eye %	Ck. %	Lj %	C.P.†
76.0	36.9	33.3	15.8	25.7	30.4	31.6	19.8	39.5	18.4
81.0	38.2	33.4	14.8	25.9	29.1	33.3	21.5	40.8	17.9
84.0	36.9	32.7	16.4	27.2	31.0	34.6	20.0	43.5	15.5
84.0	37.0	32.2	18.5	25.2	33.3	36.3	21.5	41.8	19.0
86.5	38.1	34.7	16.0	24.3	30.0	30.0	20.0	40.0	16.8
87.8	36.6	35.4	16.1	25.2	29.0	30.6	21.5	41.8	19.0

† = % of standard length  
% = % of head length

Dorsal head profile slightly curved, sloping at an angle of  $40^{\circ}$ – $50^{\circ}$ ; in 2 specimens the snout profile slopes even more steeply than the head profile. Snout 1.1 (mode)–1.2 times broader than long.

Lower jaw horizontal or very slightly oblique, 1.5–1.8 times as long as broad. Jaws equal anteriorly. Posterior tip of the maxilla reaching a vertical through the anterior part of the eye or almost to the pupil.

Caudal peduncle 1.3–1.8 times as long as deep.

*Gill rakers*: 9 on the lower part of the first gill arch, the lower 1 or 2 rakers reduced, the upper 3–5 flattened, sometimes divided and anvil-shaped; intervening rakers of varied form, from relatively slender to relatively stout.

*Scales*: ctenoid; lateral line with 32 (f.5) or 33 (f.1) scales, cheek with 3 rows. Six and a half to 8 (mode  $6\frac{1}{2}$ ) scales between the upper lateral line and the dorsal fin origin, 6–8 (mode 7) between the pectoral and pelvic fin bases. Scales on the ventral chest region noticeably smaller than those situated laterally on the chest, or those on the belly.



*Fins.* Dorsal with 23 (f.1) or 24 (f.5) rays, comprising 15 (f.4) or 16 (f.2) spines and 8 (f.3) or 9 (f.3) branched rays. Anal with 11 (f.2) or 12 (f.4) rays, comprising 3 spines and 8 or 9 branched rays. Pectoral 31.0-33.1 % of standard length. Pelvics with the first and second rays produced and filamentous. Caudal slightly emarginate, scaled on its proximal half.

*Teeth.* The *outer* teeth in the *upper jaw* are an admixture of stout, unequally bicuspid and tricuspid teeth, with the bicuspid predominating. Posteriorly, the teeth are unicuspid and caniniform. There are 50-64 teeth.

In the *lower jaw*, the *outer* teeth are stout and unequally bicuspid anteriorly and laterally, but tricuspid posteriorly and posterolaterally.

The *inner* teeth in both jaws are tricuspid, and are arranged in 2 rows.

*Osteology.* No complete skeleton is available. The *lower pharyngeal bone* has a triangular dentigerous surface, 1.2 times as broad as long. The teeth are bicuspid, relatively coarse, and are arranged in 30-38 rows, those of the 2 median rows being somewhat coarser than the lateral teeth.

*Coloration in life.* *Males:* dorsal surface of head and body light grey with a distinct orange overtone; light orange on the operculum and flanks, belly dark blue-black. The flanks are crossed by 3-5 dark vertical bars which extend from the belly to the upper lateral line; these bars have turquoise highlights, as do the lateral surfaces of the caudal peduncle. The lower jaw is grey, with a turquoise sheen; the branchiostegal membrane is sooty. The ventral limb of the preoperculum has a broad, dark blotch, and 2 distinct parallel dark bands cross the snout. Above each eye there is a dark spot, the spots from each side almost meeting in the midline.

The dorsal fin is hyaline, with orange-red lappets and similarly coloured (but fainter) streaks between the spines; very distinct orange-red spots occur between the branched rays. Caudal fin is hyaline but with a reddish-orange flush. Anal with a narrow greyish area at its base but becoming faintly reddish-orange distally; the ocelli are yolk-yellow.

The coloration of *live females* is unknown.

*Preserved material.* *Males:* Dorsal surface of the head and the upper part of the body light brown. Chest, belly and almost the entire lateral aspect of the caudal peduncle have a dusky overlay; however, as the scales in these regions have light blue-grey centres, the overall coloration varies from blue-black to dark grey. Arising from the dark ventral colour of the belly and chest are 4 broad, dark stripes, lanceolate in outline, with the taper beginning just below the level of the upper lateral line; from this point dorsally, the stripe narrows rapidly and becomes much less definite until it disappears immediately below the dorsal fin base. The first stripe passes over the axil of the pectoral fin; above this point it meets a broad vertical dark stripe on the posterior margin of the operculum. The last body stripe may barely be distinguishable from the dark ground colour of the caudal peduncle. The ground colour of the body between the stripes is light, much lighter than that of the dorsal body surface.

The area of the operculum not covered by the dark posterior band is silvery. The horizontal limb of the preoperculum is blue-black or brownish, the ventral limb

covered by a broad and short dark bar which expands anteriorly onto the cheek. A wide and intense lachrymal stripe extends through the eye onto the nape; the stripes from each side are narrowly separated medially above the orbit. Two distinct, narrow, parallel bands cross the snout anterior to the orbit. In some specimens the lower jaw is blackish, in others it is brownish; the colour is correlated with that of the branchiostegal membrane which may be entirely black or pale with just the posterior (i.e. opercular) part black.

The dorsal fin is yellowish to greyish darkest basally, and with black lappets. Caudal dark basally (the extent variable and its outline irregular), hyaline distally. Anal dark (almost dusky) along the proximal half, yellowish distally, the ocelli large and dead-white. Pelvic fins are black.

*Female* coloration is unknown.

*Ecology.* The 6 known specimens came from a trawl haul near Mwama island. Because this particular haul was made over both hard (rock and shingle) and soft (mud) substrates, and at depths from 70–200 feet, little can be said about the habitat of *H. cinctus*.

Only one fish contains ingested material in the gut; the stomach and intestine are filled with colonial blue-green algae, diatoms and other algaecious material. Only the diatoms show signs of digestion. Since the intestine of *H. cinctus* is long and coiled, it is reasonable to assume that the species feeds principally on plant matter.

The 6 male fishes (76.0–87.5 mm. S.L.) on which this description is based, are all adults and are sexually active.

*Diagnosis and affinities.* In all morphological characters, except male coloration, *H. cinctus* is indistinguishable from *H. paropius*. Yet, in both live and preserved coloration, males of the two species are immediately distinguishable; regrettably no females of *H. cinctus* are available for comparison.

Live fishes differ in obvious and subtle ways (compare p. 17 above with p. 13). Among the obvious differences may be cited the grey-orange head coloration of *H. cinctus* compared with the deep red of *H. paropius*; the clear-cut transverse barring on the flanks of *H. cinctus*, the bars arising from a deep blue-black chest and belly, compared with the silver belly and very faint (or more usually, invisible) bars in *H. paropius*; and finally, the red branchiostegal membrane of *H. paropius* compared with the dusky membrane in *H. cinctus*.

The most obvious interspecific differences in preserved coloration are the dark chest and belly of *H. cinctus*, and the distinct, dorsally incomplete bars on the flanks. No specimen of *H. paropius* has a dark chest and belly (despite the dark margin to the scales in that region) and even in those specimens with bars on the flanks, the bars are much fainter.

These differences may not seem impressive in print but are striking when specimens (especially live fishes) are compared.

Because of the close similarity between *H. cinctus* and *H. paropius*, the comparison of that species with others resembling it can be applied to *H. cinctus* as well (see p. 14). *Haplochromis cinctus* and *H. paropius* are clearly derived from the same stem, and possibly even from the same ancestral species.

## STUDY MATERIAL AND DISTRIBUTION RECORDS

Museum and Reg. No.	Locality	Collector
	UGANDA	
B.M. (N.H.) 1968.8.30.13 (Holotype)	Near Mwama island . . . . .	E.A.F.F.R.O.
B.M. (N.H.) 1968.8.30.14-18	Near Mwama island . . . . .	E.A.F.F.R.O.

*Haplochromis erythrocephalus* sp. nov

(Text-figs. 9-11)

HOLOTYPE: an adult male, 74.0 mm. S.L. (B.M. [N.H.] reg. no. 1968.8.30.251) from the Buvuma channel, south of Ramafuta island.

The trivial name refers to the bright red colour of the head in adult males.

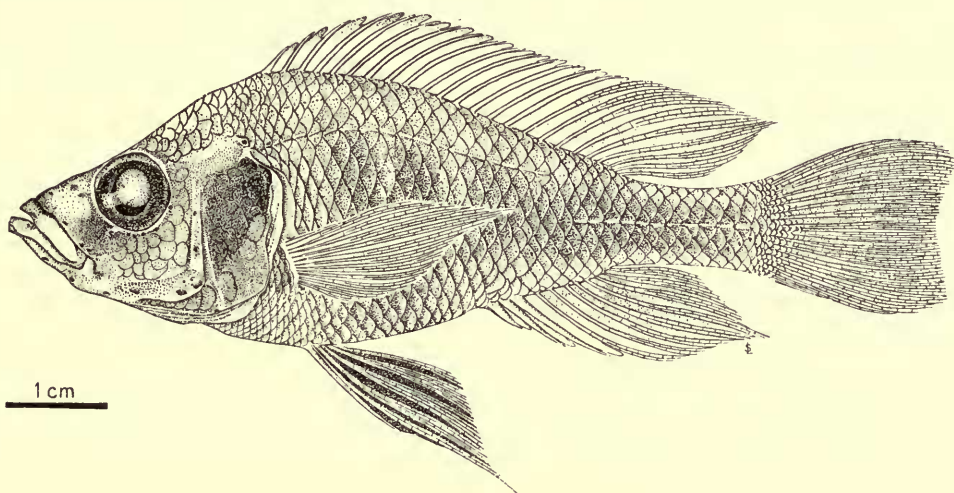


FIG. 9. *Haplochromis erythrocephalus*. Holotype. Drawn by Sharon Lesure.

DESCRIPTION: based on 41 specimens (including the holotype) 58.0-77.0 mm. S.L. Depth of body 34.5-41.5 ( $M = 37.1$ ) % of standard length, length of head 30.4-35.8 ( $M = 33.1$ ) %.

Dorsal head profile with a gentle concavity above the eye, sloping fairly steeply at an angle of 30°-40°.

Preorbital depth 13.6-17.4 ( $M = 15.8$ ) % of head, least interorbital width 22.7-27.9 ( $M = 24.6$ ) %. Snout 1.0-1.2 (mode 1.1) times as broad as long, its length 27.0-32.5 ( $M = 29.3$ ) % of head, diameter of eye 28.6-35.0 ( $M = 31.2$ ), depth of cheek 17.7-23.8 ( $M = 20.8$ ) %.

Caudal peduncle 15.1-20.0 ( $M = 17.9$ ) % of standard length, 1.3-2.0 times as long as deep. These data were obtained from specimens collected at 3 different localities, and it seems possible that there are population differences in the relative depth of the caudal peduncle. Fishes from 2 localities (Buvuma Channel south of



Ramafuta island, and off Bonga Point at the entrance to Pilkington Bay) have shallower peduncles (i.e. more are in the range 1.8–2.0 times as long as deep) than those from Pilkington Bay itself (predominantly in the range 1.5–1.6 times). It must be noted, however, that the samples from Bonga Point ( $N = 9$ ) and Buvuma Channel ( $N = 11$ ) are smaller than that from Pilkington Bay ( $N = 21$ ).

Mouth oblique, sloping at an angle of  $30^{\circ}$ – $35^{\circ}$  (occasionally as steeply as  $40^{\circ}$ ). Jaws equal anteriorly; length of lower jaw 40.2–46.8 ( $M = 43.6$ ) % of head, 1.9–2.6 (mode 2.0) times as long as broad. Posterior tip of the maxilla reaching a vertical through the anterior orbital margin, occasionally a little posterior to this point.

*Gill rakers*: 10 (rare)–13, mode 12, on the lower part of the first arch. Lower 1–3 rakers reduced, upper 1–4 usually flattened, often branched, with the uppermost 1 or 2 anvil-shaped; intervening rakers simple, from relatively stout to slender. In a few specimens none of the upper rakers is flattened, the entire series (except the lower part) composed of unbranched, stout to slender rakers.

*Scales*: ctenoid; lateral line with 30 (f.1), 31 (f.10), 32 (f.20) or 33 (f.7) scales, cheek with 3 (rarely 2) rows. Five (rare) to 7 (rare), mode 6, scales between the upper lateral line and the dorsal fin origin, 5–7 (modal range 6–7) between the pectoral and pelvic fin bases.

*Fins*. Dorsal with 23 (f.5), 24 (f.21), 25 (f.14) or 26 (f.1) rays, comprising 15 (f.22) or 16 (f.19) spines and 8 (f.13), 9 (f.23) or 10 (f.5) branched rays. Anal with 10 (f.1), 11 (f.20), 12 (f.18) or 13 (f.2) rays, comprising 3 spinous and 7–10 branched rays. Pectoral 24.6–34.8 ( $M = 31.0$ ) % of standard length. Pelvics with the first ray produced in both sexes; too few females are available to check on possible sexual dimorphism in relative elongation. Caudal truncate or slightly emarginate, scaled on its proximal half.

*Teeth*. Except posteriorly (and to a certain extent posterolaterally) the *outer teeth* in *both jaws* are mostly somewhat compressed and unequally bicuspid (Text-fig. 10). In some individuals the major cusp tends to be obliquely truncate (rather than almost equilateral in outline).



FIG. 10. *Haplochromis erythrocephalus*. Upper jaw teeth (anterior view), showing variation in crown shape. Scale equals 0.5 mm.

The *posterior upper* teeth are either unicuspid or tricuspid, and are markedly smaller than the anterior and lateral teeth; furthermore, these posterior teeth are deeply embedded in gum tissue and are partly hidden by a fold of the lip. The *posterior lower* teeth do not show such a marked size discrepancy, are usually bicuspid (but with cusps of almost equal size) and are exposed.

There are 42–70 ( $M = 56$ ) outer teeth in the upper jaw.

All *inner teeth* are tricuspid and compressed, implanted more or less vertically, and are arranged in 2 (rarely 1) rows in the upper jaw and a single (less frequently double) row in the lower jaw.

*Osteology.* The *neurocranium* of *H. erythrocephalus* is essentially similar to that of *H. empodisma* (see fig. 5, in Greenwood, 1956 [the species was then wrongly identified as *H. michaeli*, see Greenwood, 1960, p. 265]). Thus it differs from the neurocranial type found in such species as *H. macrops*, *H. brownae* and *H. nubilus*, species whose syncranial architecture is thought to be of a generalized type. Parenthetically it can be noted that similar generalized neurocrania are found in species like *H. obliquidens* and *H. phytophagus* which have a specialized dentition and feeding habits (see Greenwood, 1956 and 1966).

The skull of *H. erythrocephalus* departs from the generalized type in having a flat, moderately steep dorsal profile (compared with a curved and steep profile), relatively narrower interorbital and otic regions, and a rather more elongate and narrower preorbital part of the skull.

The *dentary* also resembles the *H. empodisma* type in being relatively more slender and elongate than the generalized type.

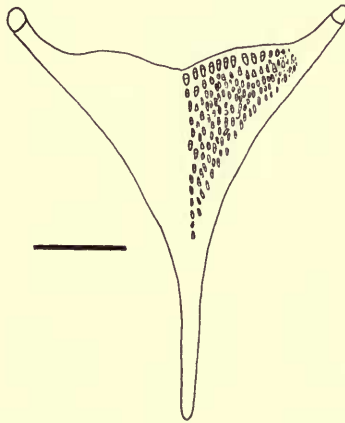


FIG. 11. *Haplochromis erythrocephalus*. Lower pharyngeal bone. Scale equals 2 mm.

The *lower pharyngeal bone* is fine, its triangular dentigerous surface 1.1-1.3 times as broad as long (Text-fig. 11). The teeth are slender, compressed and cuspidate, and are arranged densely but irregularly in from 40-46 rows.

*Coloration in life. Adult males:* The dorsal aspects of the head are bright red, the red pigment extending onto the dorsal part of the body where it becomes fainter and takes on the appearance of a red flush. Body coloration yellowish with a silvery overlay on the flanks and belly.

The dorsal fin is pinkish-red, the caudal has a red flush on its dorsal half with the remainder yellowish to hyaline; anal fin hyaline, with 2 or 3 orange ocelli. Pelvic fins are black.

The live colours of *females* have not been recorded.

*Preserved material.* *Adult males:* ground colour light fawn to yellowish, a faint purplish-grey area extends over most of the caudal peduncle and then anteriorly as a narrow band or a series of blotches situated midlaterally on the flanks. In some specimens the belly is dusky, and scales in that region have a dark margin. The snout and preorbital region are greyish, with faint indications of 2 narrow, dusky transverse bars across the snout; a dusky, near vertical lachrymal bar extends from the lower orbital margin to the angle of the jaws.

All fins except the pelvics are hyaline, the dorsal with dusky lappets, and the central region of the caudal with a dusky zone; the anal ocelli are faint and greyish in colour. The pelvic fins vary from dusky to intense black.

*Females* are uniformly light straw-yellow except for a grey snout and preorbital region. Dorsal and caudal fins are greyish, the anal and pelvic fins hyaline, the caudal with a dark base.

*Ecology. Habitat.* The material used in this description came from 3 localities, viz. Pilkington Bay (depth 30–35 feet, over mud), Bonga Point at the entrance to Pilkington Bay (45–60 feet, over mud) and from the Buvuma Channel south of Ramafuta island (90–100 feet, over mud). Personal observations on trawl catches made in other parts of the Buvuma Channel and in the Napoleon Gulf (at depths of 30–100 feet) suggest that *H. erythrocephalus* has a wide distribution in off-shore localities in the northern parts of Lake Victoria.

*Food.* The guts of 26 fishes from the 3 localities were examined. In all, both the stomach and intestine are packed with colonial blue-green algae, diatoms and smaller quantities of green algae; in some fishes a few fragments of Crustacea and of insect larvae are also present.

The constitution of this ingested material closely resembles that of the organic mud substrate occurring in the areas from which the fishes were collected. Thus, we conclude that *H. erythrocephalus* feeds on the bottom mud. The ingested colonies of blue-green algae show no signs of digestion at any point in the alimentary tract. In contrast, diatoms found in the intestine are all digested, that is, only the frustules remain; diatoms in the stomach, however, are mostly intact. The crustacean and insect remains are fragmentary, irrespective of their locality in the gut, and consist only of the chitinous parts.

The stomach of *H. erythrocephalus* is large and distensible, the intestine long and coiled.

*Breeding.* With one possible exception (a male 64 mm. S.L.), all the specimens examined are adult (size range 58–77 mm. S.L.) and most are males. This bias is undoubtedly due to collectors selecting the brilliantly coloured male fishes: it cannot be used to draw any inferences about the distribution or relative abundance of the sexes.

One female (73 mm. S.L., from Bonga Point) with quiescent ovaries, has a few larvae in the buccal cavity, and was probably brooding young at the time of capture.

Too few females have been examined to decide whether or not there is any tendency for asymmetrical ovarian development. However, in some the right ovary is distinctly larger than the left one.



*Diagnosis and affinities.* Any attempt to analyse the affinities of *H. erythrocephalus* is limited by the existence of superficially similar but as yet undescribed species. For instance, we have under study at the moment four such species, and undoubtedly others will be found as more fishing is carried out in the deep, off-shore waters of the lake.

The four species mentioned above, however, can be distinguished from *H. erythrocephalus* on certain morphometric characters, and in life by differences in male coloration.

*Haplochromis erythrocephalus* does not seem to be closely related to any of the known in-shore species having small-sized adults with generalized, bicuspid outer teeth. From these species, *H. erythrocephalus* is distinguished by its coloration, longer lower jaw and, with respect to many species, its narrower interorbital width and higher gill raker count. The oblique lower jaw of *H. erythrocephalus* also serves as a diagnostic feature.

The oblique mouth, high gill raker count, the broader, more densely toothed lower pharyngeal bone, and the long intestine serve to separate *H. erythrocephalus* from *H. empodisma* juveniles of a comparable length. (*H. empodisma* occurs in some of the shallower localities from which *H. erythrocephalus* has been recorded.) In an earlier paper, Greenwood (1960) was referring to *H. erythrocephalus* when he wrote ". . . The nearest living relative of *H. empodisma* is a small and as yet undescribed species which occurs in the same habitat but is confined to shallow water". The latter part of this statement now requires correction (both species occur in deep water). For the moment, the first part still seems valid, particularly if the strength of the term "nearest relative" is diluted a little to read "A near relative . . .".

Of the known (and described) species from deeper water habitats, *H. erythrocephalus* bears some superficial resemblance to *H. paropius*, including red pigment on the head of adult males. This red coloration in *H. paropius* is, however, much darker, and there are other colour differences (*cf.* p. 21 above with p. 13). Certain anatomical differences may also be noted, *viz.* the higher gill raker count in *H. erythrocephalus* (11-13, mode 12, *cf.* 8-10, mode 9), the concave head profile of *H. erythrocephalus* (gently convex or nearly straight in *H. paropius*) and differences in the morphology of the neurocranium (*cf.* pp. 21 and 12).

*Haplochromis paropius*, like *H. erythrocephalus*, is probably not an isolated species since we have evidence of an *H. paropius* species complex. But, the diagnostic characters for *H. paropius* also serve to separate the other related species from *H. erythrocephalus*.

The neurocranium of *H. erythrocephalus* is of interest. Its shape and proportions are unlike those characterizing the skulls of other species with small-sized adults, a generalized body-form and unspecialized dentition (or even specialized grazing or browsing teeth). Instead, it closely approximates to the neurocranial form found in *H. empodisma*, trophically a generalized bottom-feeding species with an unspecialized dentition but one with larger sized adults.

The significance of these differences or resemblances in neurocranial form (and correlated characters in the syncranial skeleton) are difficult to evaluate. They may suggest that *H. erythrocephalus* was derived from a different stem than that for

many of the other *Haplochromis* species with small-sized adults and a generally unspecialized anatomy (including those new species described in this paper).

STUDY MATERIAL AND DISTRIBUTION RECORDS

Museum and Reg. No.	Locality	Collector
	UGANDA	
B.M. (N.H.) 1968.8.30.251 (Holotype)	Buvuma Channel, S. of Ramafuta isl. (90-100 feet)	E.A.F.F.R.O.
B.M. (N.H.) 1968.8.30.270-291	Pilkington Bay	E.A.F.F.R.O.
B.M. (N.H.) 1968.8.30.262-269	Bonga Point (mouth of Pilkington Bay)	E.A.F.F.R.O.
B.M. (N.H.) 1968.8.30.252-261	Buvuma Channel, N.W. of Vuga isl. (90-100 feet)	E.A.F.F.R.O.

*Haplochromis melichrous* sp. nov.

(Text-figs. 12-15)

HOLOTYPE: an adult male 98.0 mm. S.L. (B.M. [N.H.] reg. no. 1968.8.30.150) from a trawl haul made between Nsadzi island and the mainland.

The trivial name (from the Greek for honey-coloured) refers to the golden-brown coloration of female fishes.

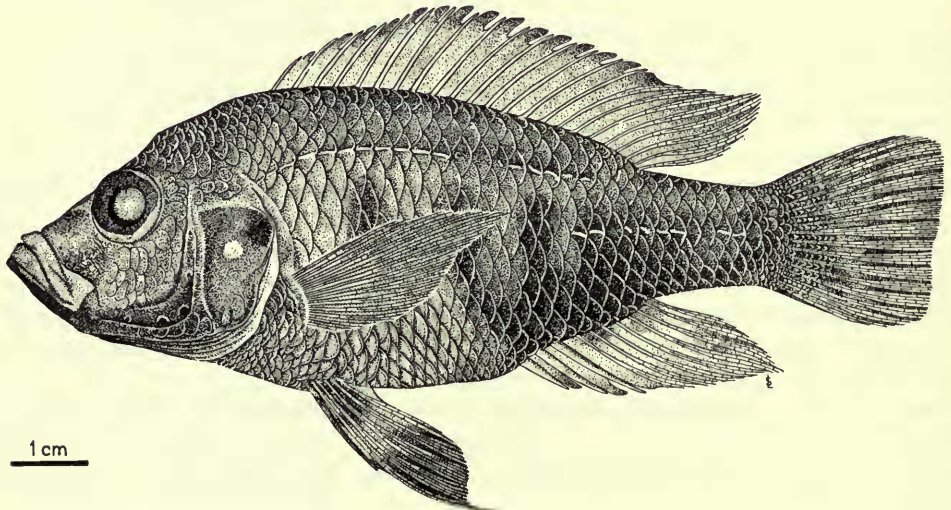


FIG. 12. *Haplochromis melichrous*. Holotype. Drawn by Sharon Lesure.

DESCRIPTION: based on 18 specimens (including the holotype) 69.0-107.0 mm. S.L.

Depth of body 36.5-44.5 (M = 39.9) % of standard length, length of head 34.2-36.1 (M = 34.9) %.

Dorsal head profile concave (strongly so in some fishes), sloping at an angle of 30°-35°. Premaxillary pedicels not prominent. Pores of the cephalic lateral line system enlarged, the tubes and pores on the preorbital being especially prominent.

Preorbital depth 14.6–18.6 ( $M = 16.4$ ) % of head, least interorbital width 18.6–23.6 ( $M = 22.1$ ) %. Snout broader than long (1.1–1.3, mode 1.3, times), its length 27.0–33.3 ( $M = 31.1$ ) % of head; eye diameter 24.5–29.8 ( $M = 27.6$ ), depth of cheek 21.7–28.5 ( $M = 25.4$ ) %.

Caudal peduncle 15.0–19.4 ( $M = 17.6$ ) % of standard length, 1.1 (rare)–1.7 (mode 1.3) times as long as deep.

Mouth oblique, sloping at an angle of 35°–40°; lower jaw projecting, with the tip lying above the tip of the premaxilla (rarely with the jaws equal anteriorly). Length of lower jaw 44.7–48.8 ( $M = 46.9$ ) % of head, 1.5–2.0 (modal range 1.8–1.9) times its breadth; a distinct mental protuberance is developed in most specimens. Posterior extension of the maxilla variable, from a point reaching a vertical slightly anterior to the orbit, to one passing through the anterior part of the eye.

*Gill rakers*: 9 or 10 on the lower part of the first arch, the lower 1–3 rakers reduced, the upper 3 or 4 flattened (some lobed, other anvil-shaped), and the intervening rakers either short and stout or relatively slender.

*Scales*: ctenoid. Lateral line with 30 (f.3), 31 (f.10) or 32 (f.4) scales, cheek with 3 or 4 rows. Five to 7 (mode 6½) scales between the upper lateral line and the dorsal fin origin, 5 or 6 (mode), rarely 7, between the pectoral and pelvic fin bases.

*Fins*. Dorsal with 23 (f.12), 24 (f.5) or 25 (f.1) rays, comprising 14 (f.2) or 15 (f.16) spines and 8 (f.11), 9 (f.5), or 10 (f.2) branched rays. Anal with 11 (f.15) or 12 (f.3) rays, comprising 3 spines and 8 or 9 branched elements. Pectoral fin 28.5–33.3 ( $M = 30.8$ ) % of standard length. Caudal truncate or obliquely truncate (i.e. the lower posterior margin slopes forwards and downwards), scaled on its proximal half. Pelvics with the first 2 rays produced (the first ray longer) in both sexes but proportionately more so in adult males.

*Teeth*. In the *outer row of both jaws* there is an admixture of slender, somewhat compressed bicuspid, weakly bicuspid, and unicuspid (Text-fig. 13); the relative proportions of the different types shows great individual variability. Teeth situated laterally and posterolaterally in the premaxilla are strongly incurved, and in most specimens the posterolateral teeth are enlarged. The posterolateral and posterior teeth in the lower jaw are often tricuspid and small. There are 56–80 ( $M = 68$ ) outer teeth in the upper jaw.

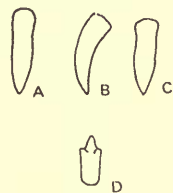


FIG. 13. *Haplochromis melichrows*. A–C upper jaw teeth. A and C: in anterior view. B: in lateral view. D: tricuspid tooth from the lower jaw. Scale equals 1 mm.

The *inner teeth* are tricuspid (sometimes weakly so) and are very obliquely implanted so as to lie almost horizontally. There are 2 (rarely 3) series of inner teeth in the upper jaw, and 2 (rarely 1) in the lower jaw.

*Osteology*: The *neurocranium* of *H. melichrous* (Text-fig. 14) resembles that of *H. victorianus*; in other words it is referable to the "*serranus*" group (see Greenwood, 1967, p. 109). It differs from the neurocranium of *H. victorianus*, however, in having a narrower and more acute preorbital region.

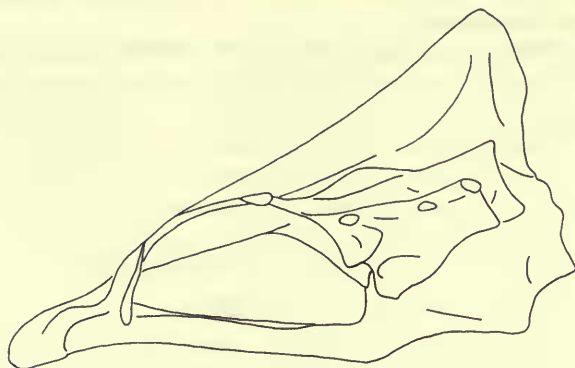


FIG. 14. *Haplochromis melichrous*. Neurocranium in left lateral view. Scale equals 2 mm.

The *premaxilla* is slightly expanded medially and anteromedially, and its lateral and posterolateral teeth are strongly incurved.

The *dentary* has a strong mental protuberance; although the openings into the lateral line tubes are enlarged, the tubes themselves are not hypertrophied.

The dentigerous surface of the *lower pharyngeal bone* is as broad as long, or slightly broader (Text-fig. 15). The teeth are fine, and arranged in from 30–34 rows; apart

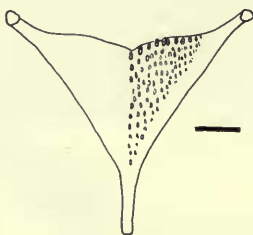


FIG. 15. *Haplochromis melichrous*. Lower pharyngeal bone. Scale equals 2 mm.

from the posterior pair of teeth in the median row, no others in this row are noticeably coarser than the lateral teeth.

*Coloration in life*. *Males* have a dark ground colour but with lighter, faintly iridescent greyish patches on the flanks, and sometimes three faint transverse bars on the anterior flanks. The dorsal fin is hyaline with dark lappets, the caudal hyaline and faintly maculate. The anal fin is dusky at its base and hyaline or faintly red distally; the ocelli are large and orange. Pelvic fins are black.



*Females* are dark golden-brown on the dorsal aspects of the body and on the flanks, shading to silver ventrally; a faint, dark midlateral stripe is generally visible. The dorsal fin is faintly golden-brown proximally. The pelvics are hyaline.

*Preserved material. Males:* have a yellow-brown ground coloration. The chest region is silvery but the scales here (and on the belly) are edged with black. The snout, lower jaw, branchiostegal membrane, lower part of the preoperculum, the entire interoperculum and most of the ventral aspects of the operculum are dusky. The ventral half to two-thirds of the body posterior to the vent is also dusky; 3-5 broad but relatively faint vertical bars originate from this dark area, and extend upwards to the level of the upper lateral line or slightly higher (but never to the dorsal body outline).

Dorsal fin dark grey to dusky, the lappets black. Caudal fin greyish to dusky, darkest basally, and maculate distally. The anal fin is dusky distally, black basally and over the spinous part; the ocelli are whiteish but very indistinct. The pelvic fins are black.

The smallest male examined (74 mm. S.L., adult but apparently quiescent) has the overall tone of the ventral body half much lighter than in the other specimens, but the margins of the scales in this region are very dark.

*Females* are greyish-yellow above the midlateral line, light yellow-brown below, with a faint silver overlay on the chest region. Most specimens have a faint but broad midlateral stripe, interrupted at about its mid-point for a variable distance; sometimes only a short (i.e. about 5 scale rows long) anterior part of this stripe is detectable. The tip of the lower jaw is dusky, and there is a short, rather indistinct lachrymal stripe which does not reach the ventral margin of the preoperculum. The dorsal and caudal fins are greyish, the latter sometimes maculate but always with the proximal part darkest. Anal and pelvic fins are hyaline.

*Ecology. Habitat.* The specimens described above came from trawl hauls made in water 70-100 feet deep, over a mud bottom between Nsadzi island and the mainland. One of us (J.M.G.) has identified *H. melichrous* in catches made south of this island over a similar bottom but at depths of from 130-160 feet.

*Food.* Little information could be gathered from the 10 guts examined. Most were almost empty save for small quantities of mud and fragments of crustaceans (probably *Caridina* sp); other fragments (taken from 3 guts) were tentatively identified as being remains of pupal Diptera.

*Breeding.* All except one of the specimens available (69-107 mm. S.L.) are adults; the smallest fish is a juvenile female, but the ovaries show early signs of oogenesis. The next smallest fish (74 mm. S.L.), a male, is adult. In all 8 adult and sexually active females, the right ovary is noticeably larger than the left one.

*Diagnosis and affinities.* The concave dorsal head profile, the oblique lower jaw, broad snout, and the colours of live fishes serve to distinguish *H. melichrous* from any of the deep water *Haplochromis* species so far discovered.

*Haplochromis melichrous* does not closely resemble any of the known inshore and shallow water species; it is readily distinguished from such oblique-mouthed species as *H. cavifrons*, *H. plagiostoma*, *H. flavipinnis* and certain extreme forms of

*H. obesus* (see fig. 2 and p. 183 in Greenwood, 1959) by several morphometric and dental characters.

There are few pointers to the phyletic affinities of *H. melichrous*. Judging from the dentition and syncranial architecture, the species could be associated with the "serranus" group (see Greenwood [1967], page 109, *et seq.*) as a rather specialized off-shoot. Equally, it could be associated with the *H. flavipinnis*-*H. cavifrons* group, a species complex of uncertain affinities but one probably related (at least in part) to the "serranus" group.

#### STUDY MATERIAL AND DISTRIBUTION RECORDS

Museum and Reg. No.	Locality	Collector
	UGANDA	
B.M. (N.H.) 1968.8.30.150 (Holotype)	Between Nsadzi isl. and mainland (70-100 feet)	E.A.F.F.R.O.
B.M. (N.H.) 1968.8.30.151-167	Between Nsadzi isl. and mainland (70-100 feet)	E.A.F.F.R.O.

#### *Haplochromis laparogramma* sp. nov.

(Text-figs. 16-19)

HOLOTYPE: an adult male 78.0 mm. S.L. (B.M. [N.H.] reg. no. 1968.8.30.220) from north of Nsadzi island.

The trivial name refers to the conspicuous midlateral stripe.

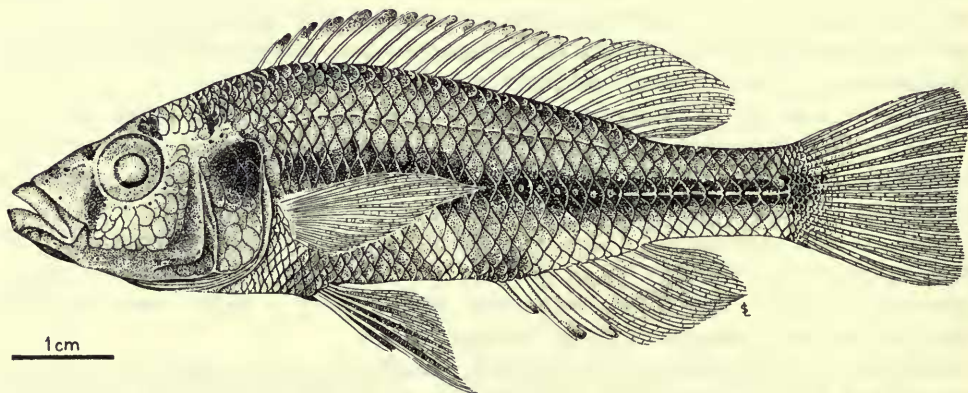


FIG. 16. *Haplochromis laparogramma*. Holotype. Drawn by Sharon Lesure.

DESCRIPTION: based on 25 specimens (including the holotype), 61.0-84.5 mm. S.L.

Depth of body 27.5-31.1 (M = 29.3) % of standard length, length of head 30.1-33.8 (M = 30.5) %.

Dorsal head profile straight or slightly curved in the nuchal region, sloping at an angle of 25°-30°.



Preorbital depth 14.6–18.8 ( $M = 16.3$ ) % of head, least interorbital width 24.0–27.0 ( $M = 25.7$ ) %. Snout as long as broad to 1.3 times broader than long (mode 1.1 times), its length 27.4–31.9 ( $M = 30.2$ ) % of head, eye diameter 26.7–32.6 ( $M = 30.0$ ), depth of cheek 15.8–21.3 ( $M = 19.5$ ) %.

Caudal peduncle 17.7–22.0 ( $M = 20.0$ ) % of standard length, 1.7–2.1 (modal range 1.8–1.9) times as long as deep.

Lower jaw sloping fairly steeply at an angle of 25°–35° (less frequently at *ca.* 20°), its length 40.7–45.4 ( $M = 42.8$ ) % of head, and 1.8–2.6 (mode 2.2) times its breadth. Jaws equal anteriorly or the lower projecting slightly, terminating in a low mental protuberance. Posterior extension of the maxilla variable, from a point slightly anterior to the orbital margin to one below the anterior part of the eye.

*Gill rakers*: 11 (mode) or 12, rarely 10 or 13, on the lower part of the first gill arch. The lower 1–4 rakers are reduced, the upper 2–5 flattened, sometimes branched and often anvil-shaped; intervening rakers are relatively slender.

*Scales*: ctenoid; lateral line with 32 (f.4), 33 (f.10), 34 (f.6) or 35 (f.2) scales, cheek with 3 (rarely 2 or 4) rows. Five and a half or 6 scales between the upper lateral line and the dorsal fin origin, 5–6 (mode) rarely 7, between the pectoral and pelvic fin bases.

*Fins*. Dorsal with 24 (f.10), 25 (f.14) or 26 (f.1) rays, comprising 15 (f.18) or 16 (f.7) spines and 9 (f.16) or 10 (f.9) branched rays. Anal with 11 (f.10) or 12 (f.15) rays, comprising 3 spines and 8 or 9 branched rays. Pectoral 24.4–30.1 ( $M = 27.7$ ) % of standard length. Pelvics with the first ray produced in both sexes. Caudal truncate, scaled on its basal half.

*Teeth*. Except posteriorly in both jaws, the *outer* teeth are compressed and unequally bicuspid (Text-fig. 17); in a few specimens there are tricuspid, compressed

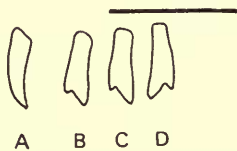


FIG. 17. *Haplochromis laparogramma*. Upper jaw teeth, all from one fish, to show variation in crown shape. A: lateral view. B–D: anterior view. Scale equals 2 mm.

teeth interspersed among the bicuspids. Most individuals have weakly bicuspid or unicuspid, or (less commonly) tricuspid teeth posteriorly in the upper jaw, and tricuspids in the same position in the lower jaw. Exceptionally, there are bicuspid teeth throughout the outer row. In both jaws the posterior teeth are smaller than the anterior and lateral ones. Not infrequently the posterior quarter of the premaxilla is edentulous.

There are 46–62 ( $M = 54$ ) outer teeth in the upper jaw.

The *inner teeth* are tricuspid, and are arranged in 2 (less commonly 3) series in the upper jaw and 1 or 2 series in the lower jaw.

*Osteology*. The *neurocranium* is close to a generalized type (see Greenwood, 1962) but shows certain specializations, such as the rather more protracted preorbital

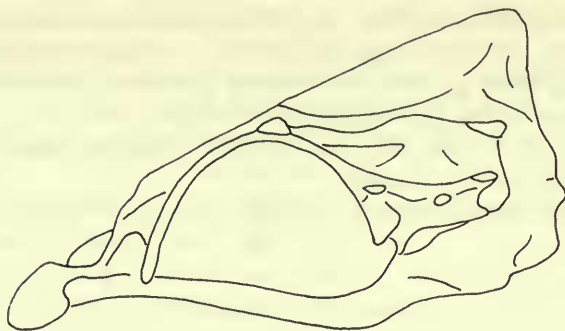


FIG. 18. *Haplochromis laparogramma*. Neurocranium in left lateral view. Scale equals 2 mm.

region which is also less steeply sloping and is straighter (Text-fig. 18). Also, the otic region is narrower than in the generalized type (greatest breadth contained *ca.* 2 times in neurocranial length *cf.*  $1\frac{1}{2}$  times).

Broadly speaking, the neurocranium of *H. laparogramma* can be considered intermediate between the *H. brownae* type and the *H. serranus* type (see Greenwood, *op. cit.*).

Lateral line canals on the neurocranium are not enlarged, and neither are those on the dentary; the canals on the preorbital bone, however, are slightly enlarged.

The *dentary* departs slightly from the generalized type since it is relatively elongate. The *premaxilla* shows the development of a slight beak through the expansion of its anterior and anterolateral dentigerous surfaces.

The *lower pharyngeal bone* is slender and rather narrow (Text-fig. 19). Its dentigerous surface is as long as broad, and carries 32–38 rows of slender, cuspidate teeth.

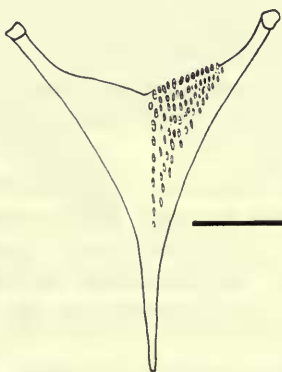


FIG. 19. *Haplochromis laparogramma*. Lower pharyngeal bone. Scale equals 2 mm.

*Coloration in life.* *Adult males* have the dorsal part of the body dark blue, shading to greenish-silver on the flanks, and silver on the belly. A dark midlateral stripe

runs from behind the head to the origin of the caudal fin. Dorsal aspects of the head vary from brownish to yellowish-brown; the snout is sometimes crossed by 2 distinct dark bars which are weakly chevron-shaped, the apex directed orally. The opercular region and the cheek are yellowish, but the branchiostegal membrane is dusky. The dorsal and caudal fins are pale yellowish-orange, the anal is hyaline with orange ocelli. Pelvic fins are black.

Live coloration for *females* is unknown.

*Preserved coloration.* *Males*: are light to dark brown on the dorsal half of the body and caudal peduncle, silvery below, with a faint duskiness on the chest, belly and, in some specimens, the flanks as well. The brown and silver colours are distinctly demarcated by a broad midlateral stripe extending from behind the operculum to the caudal origin. This stripe is of variable thickness, being broadest over the anterior two-thirds of its length. The snout is dusky, with faint traces of 2 darker transverse bars, the upper of which is interocular in position; in some fishes the occiput is also dusky. In all specimens there is a faint but broad lachrymal stripe, and in some a faint prolongation of the midlateral band across the operculum to the vertical preopercular limb. The branchiostegal membrane is dusky.

Dorsal and anal fins are hyaline, with faintly dusky lappets; the anal ocelli are dead-white. The caudal fin is also hyaline but becomes darker near the base. The pelvic fins vary from dusky to black.

The preserved coloration of *females* is similar to that of males but lacks the ventral duskiness on the chest, belly and flanks.

*Ecology. Habitat.* The species has been recorded from 4 off-shore localities. In all, the bottom was of mud, and the depth varied from 50-110 feet. *Haplochromis laparogramma* has not yet been identified from catches made in deeper water.

*Food.* The guts of 20 individuals from 3 different localities have been examined. Apart from 5 empty guts, all contained varying amounts of fragmentary larval and pupal Diptera. In none was any bottom detritus recorded, thus suggesting that *H. laparogramma* does not feed directly on the bottom.

*Breeding.* All the specimens available (61-85 mm. S.L.) are adults; in the 3 females examined, the right ovary is clearly larger than the left one, the discrepancy being most marked in the single "ripe" individual.

*Diagnosis and affinities.* For the moment it is difficult to suggest the relationships of *H. laparogramma*, but this may become simpler when more is known about the *Haplochromis* species from deeper water habitats. Certainly *H. laparogramma* cannot be closely associated with any of the known inshore species having a similar general facies, as for example, *H. longirostris* (see Greenwood, 1962).

Among the deep water "trawl species", *H. laparogramma* may be related to *H. fusiformis* (see p. 32). Superficially *H. laparogramma* is distinguished by its coloration, slightly broader snout, larger eye (possibly correlated with the smaller adult size of the species), coarser teeth, larger scales on the nape, and its smaller adult size.

## STUDY MATERIAL AND DISTRIBUTION RECORDS

Museum and Reg. No.	Locality	Collector
	UGANDA	
B.M. (N.H.) 1968.8.30.220 (Holotype)	N. of Nsadzi isl. (70-100 feet)	E.A.F.F.R.O.
B.M. (N.H.) 1968.8.30.233-239	Buvuma Channel, W. of Vuga isl. (108 feet)	E.A.F.F.R.O.
B.M. (N.H.) 1968.8.39.240-251	Off the Bulago-Tavu bank (50- 75 feet)	E.A.F.F.R.O.
B.M. (N.H.) 1968.8.30.221-232	N. of Nsandzi isl. (70-100 feet)	E.A.F.F.R.O.

*Haplochromis fusiformis* sp. nov.

(Text-fig. 20)

HOLOTYPE: an adult female 110.0 mm. S.L. (B.M. [N.H.] reg. no. 1968.8.30.28) from the Buvuma Channel, west of Nienda and Vuga islands, at a depth of 108 feet. The trivial name refers to the slender, elongate body form of this species.

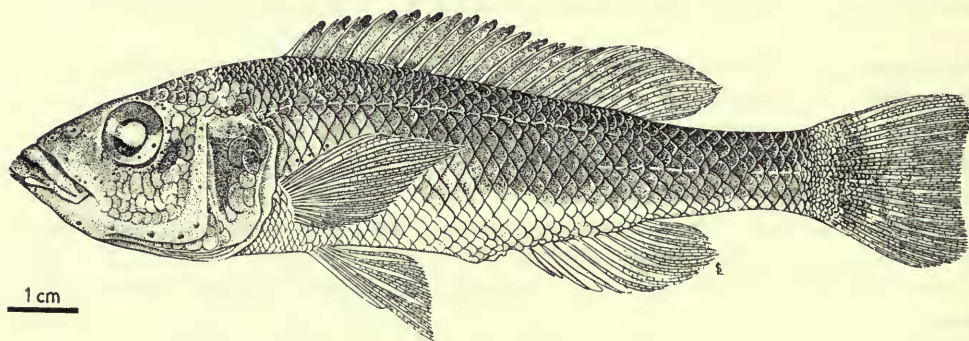


FIG. 20. *Haplochromis fusiformis*. Holotype. Drawn by Sharon Lesure.

DESCRIPTION: based on 10 specimens (including the holotype) 74.5-110.0 mm. S.L.

Depth of body 23.2-25.5 (M = 24.6) % of standard length, length of head 30.4-32.1 (M = 31.3) %. Dorsal head profile slightly curved, sloping at an angle of about 30°, its outline broken by the fairly prominent premaxillary pedicels. The openings to the cephalic lateral line system are not noticeably enlarged.

Preorbital depth 15.7-19.3 (M = 17.4) % of head, least interorbital width 21.9-26.0 (M = 24.5) %. Snout 1.0-1.2 (mode 1.1) times as long as broad, its length 29.4-34.4 (M = 31.9) % of head, eye diameter 23.4-27.7 (M = 26.3), depth of cheek 15.4-21.4 (M = 18.9) %.

Caudal peduncle 18.6-21.4 (M = 20.0) % of standard length, 1.9-2.1 (modal range 2.0-2.1) times as long as deep.

Lower jaw sloping at an angle of ca. 20°-30°, jaws equal anteriorly or the lower projecting slightly, its length 40.4-43.8 (M = 42.2) % of head, and 2.0-2.6 (no distinct mode) times its breadth. Posterior tip of the maxilla reaching a vertical



slightly anterior to the orbital margin, or more posteriorly to one through the orbital margin.

*Gill rakers*: ten or 11 on the lower part of the first arch, the lower 1-3 rakers reduced, the upper 2-5 flattened and branched; intervening rakers are relatively slender.

*Scales*: ctenoid; lateral line with 34 (f.2), 35 (f.3), 36 (f.2) or 37 (f.1) scales, cheek with 3 or 4 rows. Seven or 8 (rarely 6) between the dorsal fin origin and the upper lateral line, 5 or 6 (mode) between the pectoral and pelvic fin bases.

*Fins*. Dorsal with 25 (f.2) or 26 (f.8) rays, comprising 15 (f.2), 16 (f.7) or 17 (f.1) spines and 9 (f.2), 10 (f.7) or 11 (f.1) branched rays. Anal with 11 (f.4), 12 (f.5) or 13 (f.1) rays, comprising 3 spines and 8-10 branched rays. Pectoral 23.1-27.0 ( $M = 25.1$ ) % of standard length. Caudal truncate (obliquely so in 2 specimens), scaled on its proximal half to three-fifths. Pelvics with the first ray slightly produced in both sexes, but relatively more so in males.

*Teeth*. Slender but compressed, unequally bicuspid teeth predominate in the outer row of both jaws in almost all specimens, but the posterior teeth in the lower jaw are generally tricuspid or weakly tricuspid. Some weakly bicuspid, or unicuspid teeth occur anteriorly in both jaws.

Two exceptional specimens have mostly unicuspid teeth laterally and anteriorly in both jaws, with a few bicuspid teeth interspersed.

There are 44-64 outer teeth in the upper jaw; the 2 largest specimens have the lowest number of teeth (44 and 48), an unusual inverse correlation.

In most specimens the posterior quarter of the premaxilla is edentulous, but in a few the bone is toothed along its entire length.

The *inner rows* are composed of tricuspid or weakly tricuspid teeth arranged in 2 (mode) or 3 series in the upper jaw and 1 or 2 series in the lower jaw.

*Osteology*. No complete skeleton is available. The *lower pharyngeal bone* is fine, its denticerous surface 1.1-1.2 times as broad as long, and carries 34-36 rows of slender, weakly cuspidate teeth.

*Coloration of live fishes*. *Males* have the dorsal part of the body brilliant purple-blue, shading to silvery-yellow on the flanks, and becoming dusky on the ventral surfaces. All fins (except the black pelvics) are dark basally and hyaline distally; the anal has 2 or 3 white ocelli.

*Females* have the dorsal part of the body blue-grey, shading to silver on the flanks and ventral surfaces. Fins are coloured as in the males, except that the pelvics are hyaline and there are no ocelli on the anal.

*Preserved material*. *Males* have a dark grey-brown ground coloration, but are sooty on the chest, belly and that area of the ventral body wall above the anterior part of the anal fin (in a few exceptional specimens the chest and belly are yellow). There are no distinct cephalic markings, although in some fishes there are traces of a medially interrupted occipito-nuchal band. The branchiostegal membrane is grey brown.

The dorsal fin is grey to sooty, the lappets black; in most specimens there is a dark but poorly defined band running along the fin base. The anal is grey, darker (nearly black) basally and over the spinous part of the fin. The pelvics are black.

*Females* are greyish brown dorsally, straw yellow below; the snout and dorsal surface of the head are grey. Except for the usual dark opercular spot, the head is without markings, and the branchiostegal membrane is pale. The dorsal and anal fins are greyish to lightly sooty, the anal and pelvic fins are hyaline.

*Ecology. Habitat.* The 10 specimens available came from two off-shore areas in the Buvuma Channel. In both places the substrate is mud, the depth 90–96 feet and about 108 feet respectively.

*Food.* Four of the 9 guts examined were empty. The remainder contained small quantities of unidentifiable insect fragments (probably from pupal Diptera).

*Breeding.* All 10 fishes are probably adults, although some doubt is felt about the sexual state of one female (93 mm. S.L.); this individual might be a juvenile. Like the three other females, the right ovary in this fish is larger than the left one.

*Diagnosis and affinities.* The possible relationship between *H. fusiformis* and *H. laparogramma* is mentioned on p. 31, and the features distinguishing the 2 species are listed there. Until more specimens of *H. fusiformis* are available this tentative relationship cannot be explored further. At least for the moment, the slender, elongate body-form coupled with the moderately oblique lower jaw serve to distinguish both species from the other deep-water *Haplochromis* species.

#### STUDY MATERIAL AND DISTRIBUTION RECORDS

Museum and Reg. No.	Locality	Collector
	UGANDA	
B.M. (N.H.) 1968.8.30.28 (Holotype)	Buvuma Channel, W. of Nienda and Vuga isls. (108 feet)	E.A.F.F.R.O.
B.M. (N.H.) 1968.8.30.29–38	Buvuma Channel, W. of Nienda and Vuga isls. (108 feet)	E.A.F.F.R.O.

#### *Haplochromis dolichorhynchus* sp. nov.

(Text-figs. 21–24)

*Haplochromis tridens* (part): Greenwood, 1967, *Bull. Br. Mus. nat. Hist. Zool.*, **15**: no. 2, 97.

NOTE ON THE SYNONYMY. A single specimen (B.M. [N.H.] reg. no. 1966.3.9.165) previously identified as *H. tridens* by Greenwood (1967) is now re-identified as *H. dolichorhynchus*. This fish is the aberrantly coloured female noted on p. 99 of that paper.

HOLOTYPE: an adult male 102.0 mm. S.L. (B.M. [N.H.] reg. no. 1968.8.30.168) from Murchison Bay, at a depth of 30 feet.

The trivial name refers to the rather protracted snout of this species relative to the snout in its presumed relatives.

DESCRIPTION: based on 27 specimens (including the holotype), 67.5–119.0 mm. S.L.

Depth of body 28.6–33.6 (M = 31.9) % of standard length, length of head 33.4–36.9 (M = 35.5) %.

Dorsal head profile straight to slightly concave, sloping at an angle of 20°–30°; premaxillary pedicels fairly prominent and breaking the outline of the profile to

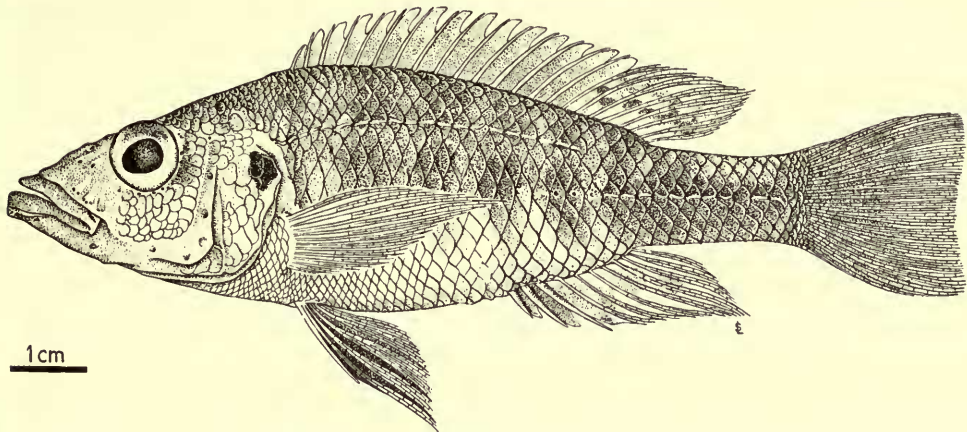


FIG. 21. *Haplochromis dolichorhynchus*. Holotype. Drawn by Sharon Lesure.

create a concavity above and a little anterior to the eye. The cephalic lateral line pores are enlarged and obvious.

Preorbital depth 16.0–19.5 ( $M = 17.7$ ) % of head, least interorbital width 16.3–21.2 ( $M = 18.8$ ) %. Snout 1.0–1.4 (mode 1.1) times as long as broad, its length 30.3–37.7 ( $M = 34.2$ ) % of head. Eye and orbit almost circular, eye diameter 25.0–29.6 ( $M = 27.2$ ) % of head, depth of cheek 16.7–23.0 ( $M = 19.6$ ) %.

Caudal peduncle 17.1–21.4 ( $M = 19.2$ ) % of standard length, 1.6–1.9 (modal range 1.7–1.8) times as long as deep.

Mouth somewhat oblique (*ca.* 15°–25°), lower jaw projecting slightly to strongly (the usual condition), and with a distinct mental protuberance; length of lower jaw 42.8–52.5 ( $M = 47.8$ ) % of head, 2.0–2.8 (mode 2.1) times as long as broad. Premaxilla distinctly expanded medially so as to give it a beaked appearance. Posterior tip of the maxilla reaching a vertical slightly anterior to the orbital margin, occasionally a little posterior to this line.

*Gill rakers*: 9–11 (mode 10), rarely 8, on the lower part of the first gill arch. The lower 1–4 rakers are reduced, the upper 3 or 4 flattened and usually divided, the intervening rakers of varied form but generally either stout or slender.

*Scales*: ctenoid. Lateral line with 31 (f.2), 32 (f.5), 33 (f.16) or 34 (f.3) scales. Cheek with 3 (mode) or 4 rows. Five to 6½ (mode 5½) scales between the upper lateral line and the dorsal fin origin, 6 or 7 (mode) between the pectoral and pelvic fin bases.

*Fins*. Dorsal with 23 (f.3), 24 (f.18) or 25 (f.5) rays, comprising 14 (f.1), 15 (f.22) or 16 (f.3) spines and 8 (f.4), 9 (f.18) or 10 (f.4) branched rays. Anal with 11 (f.12) or 12 (f.14) rays, comprising 3 spines and 8 or 9 branched rays. Pectoral 24.5–30.8 ( $M = 27.4$ ) % of standard length. Pelvic fins with the first ray produced, about equally so in both sexes. Caudal truncate, scaled on its proximal half.

*Teeth*. Except posteriorly, the *outer* teeth in the *upper* jaw are predominantly of a slender, somewhat compressed form, gently curved, with unequally bicuspid crowns (Text-fig. 22); the major cusp is noticeably produced. In many fishes there

are admixtures of bi- and weakly bicuspid teeth, or of bi- and unicuspid teeth (the latter usually situated anteriorly); rarely, some tricuspid, compressed teeth occur anteriorly and laterally in the outer row.

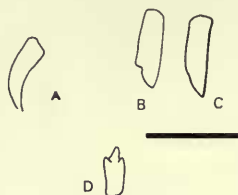


FIG. 22. *Haplochromis dolichorhynchus*. A-C upper jaw teeth. A: in lateral view. B and C: in anterior view. D: posterolateral tooth from the dentary. Scale equals 1 mm.

Posteriorly and posterolaterally it is usual to find tricuspid teeth, but unicuspid teeth and bicuspid teeth are sometimes found in this position, or there can be a combination of unicuspid teeth posteriorly with tricuspid teeth posterolaterally.

There are 50-80 ( $M = 70$ ) teeth in the outer series of the upper jaw.

The *outer row* of teeth in the *lower jaw* is usually like that in the upper jaw; when tricuspid teeth occur posteriorly, they are slightly larger than their counterparts in the upper jaw.

Only tricuspid teeth occur in the obliquely implanted *inner rows*, arranged in 2 or 3 series in the upper jaw, and 1 or 2 in the lower jaw.

*Osteology.* The *neurocranium* of *H. dolichorhynchus* closely resembles that of *H. prognathus* (see Greenwood, 1967, pp. 81, and 109 *et seq.*) being moderately shallow with a gently sloping anterior dorsal profile, and a fairly elongate preorbital region (Text-fig. 23). The neurocranial lateral line canals and pores, however, are

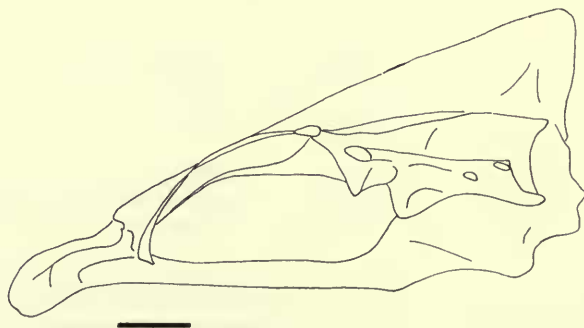


FIG. 23. *Haplochromis dolichorhynchus*. Neurocranium in left lateral view. Scale equals 4 mm.

moderately enlarged, especially when compared with the condition found in previously described species of the "*prognathus*" group (see Greenwood, 1967, *loc. cit.*).

The *premaxilla* has a pronounced beak resulting from the anterior and anterolateral expansion of its dentigerous arm; the pedicels are as long as the dentigerous arms.



The *dentary* has a marked outward flare of its upper half so that when viewed from in front, each ramus has a concave outer face. This flare is continued forward almost to the symphysis. The lower lateral faces of the symphyseal surface are produced forward as a conical mental process.

The *lower pharyngeal bone* (Text-fig. 24) has its dentigerous surface slightly longer than broad or, more frequently, a little broader than long (about 1.1-1.2 times).

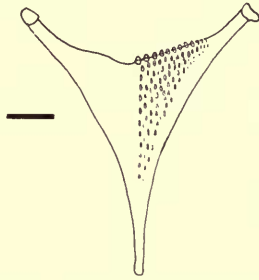


FIG. 24. *Haplochromis dolichorhynchus*. Lower pharyngeal bone. Scale equals 2 mm.

The lower pharyngeal teeth are fine and weakly cuspidate (except posteriorly), and arranged in 28-30 rows.

*Coloration in life.* Males are blueish-purple dorsally, becoming silvery on the flanks; the ventral surfaces are dusky. The lips and branchiostegal membrane are greenish-blue. Dorsal, caudal and anal fins are dark basally, hyaline distally, the dorsal sometimes with red maculae, and the caudal usually maculate; anal ocelli are orange-red. The pelvic fins vary from black to dusky.

*Females* are blue dorsally, becoming silver on the flanks and belly; the blue coloration is of variable intensity. A dark longitudinal stripe (of variable intensity) runs midlaterally along the entire body length behind the head. All fins are hyaline.

*Preserved material.* Males (*sexually active*) are brownish above, with the entire ventral half of the body and the lower four-fifths of the peduncle blue-black except for irregular silvery blotches on the flanks above the belly. There are traces of 5, ill-defined, narrow vertical bars stemming from the black ventral body coloration and extending to the dark streak lying along the dorsal fin base; a sixth faint bar is visible on the caudal peduncle. The cheek, branchiostegal membrane and operculum dark, the latter with a silvery sheen; the upper lip and lower jaw are greyish, the lower lip whiteish. A faint but broad band crosses the anterior part of the snout.

The dorsal fin is greyish, with sooty lappets and dark spots at the base of all the rays; the soft part of the fin is darkly maculate. The caudal is dark on its basal third, greyish-sooty distally and darkly maculate on its upper half. The anal dark grey with a deep, sooty basal band which expands in the region of the spines. Pelvic fins black on the proximal three-quarters medially, entirely black laterally.

*Males (sexually quiescent)* are dark yellow-brown dorsally, becoming darker on the ventral half of the body and caudal peduncle but with a silvery sheen on the chest and, less markedly, the belly. The snout is dark, but the rest of the head is yellowish-

brown; the branchiostegal membrane is sooty. The fins are as in active males, or are much paler.

In some quiescent males faint traces of the vertical black bars are visible on the body, as are the various cephalic markings, including a postocular blotch, and a transverse bar across the snout.

*Immature males* have the same coloration as females (see below) except that the pelvic fins are dusky.

*Females* have a silvery-grey ground coloration which shades to yellowish-brown ventrally. A dark, usually interrupted midlateral band runs from behind the head to the proximal quarter of the caudal fin. The margins of this band are irregular, and the band is of variable width; the band is usually interrupted above the anterior part of the anal fin, but if it is complete, it is constricted in this region. In a few specimens the band does not appear on the anterior half of the body. A few small, irregularly placed dark blotches are often present between the upper lateral line and the dorsal fin base.

The dorsal fin is light grey, with faintly dusky lappets, and often has small dark areas at the bases of the spines. Caudal fin greyish, anal and pelvic fins hyaline.

*Ecology. Habitat.* *Haplochromis dolichorhynchus* has a wide depth range from 30 to more than 100 feet. It has been caught in open off-shore waters and in a relatively sheltered bay. In all localities, the substrate is mud.

*Food.* The guts of 25 specimens from three different localities were examined. Fishes from greater depths (70–108 feet) had fed on small Crustacea (especially *Caridina* sp.) and, to a lesser degree, on pupal Diptera; small quantities of bottom mud were found in these guts. One exceptional fish had at least 5 larval cichlid fishes in its stomach, and further remains of small fishes in the intestine. Since this specimen is a female with spent ovaries, the larvae could be from its own brood (assuming, of course, that the species is a mouth-brooder).

The 8 specimens from a shallower locality (Murchison Bay, at a depth of 50 feet) had ingested considerable quantities of mud; in most cases this is the only material present, but in 2 fishes fragments of pupal Diptera were identified. Possibly the high proportion of mud in the guts is unnatural and due to the fishes being, as it were, force-fed whilst the trawl was dragged along and through the near-liquid mud.

*Breeding.* In the sample available, all fishes less than 80 mm. S.L. are immature (all these are females); 2 larger fishes (females 101 and 96 mm. S.L.) are also immature although other fishes of the same length are adult. The largest fishes are females.

There is a tendency for the right ovary in ripe females to be larger than the left one, but a definite asymmetry in ovarian development could not be detected.

*Diagnosis and affinities.* *Haplochromis dolichorhynchus* closely resembles *H. tridens* (see note on synonymy). When *H. tridens* was redescribed (Greenwood, 1967) the existence of *H. dolichorhynchus* was unknown, and the species appeared to be very distinctive. But, since that time trawling surveys in the deeper waters of Lake Victoria have produced a number of species which, together with *H. tridens* form a “*tridens*” complex of at least 5 species, and probably a sixth. Thus some

of the remarks made by Greenwood (*op. cit.*, pp. 97 and 99) about *H. tridens* (particularly with reference to the enlarged cephalic lateral line pores, the dentition, the general facies and the affinities of the species) are no longer valid.

Two species of the "*tridens*" complex are anatomically and superficially more distinct than the others, and need not be considered at this point (but see pp. 48 and 52). The more obviously similar species are *H. dolichorhynchus*, *H. tyrianthinus* (p. 40), *H. chlorochrous* (p. 44) and *H. tridens*.

As mentioned above, superficially *H. tridens* and *H. dolichorhynchus* resemble one another fairly closely. There is complete overlap in many morphometric characters, and the dentition is similar except that in *H. dolichorhynchus* the teeth are more slender and there are fewer tricuspid teeth in the outer row of either jaw.

The species also differ in the following characters: the body is slightly deeper in *H. tridens* (30.1–36.2,  $M = 33.5\%$  of standard length, *cf.* 28.6–33.6, 31.9%); this is probably correlated with the more steeply sloping dorsal head profile in *H. tridens* (40°–45° *cf.* 20°–30°). The orbit in *H. tridens* is noticeably elliptical (longer than deep) but is virtually circular in *H. dolichorhynchus*. The snout in *H. dolichorhynchus* is slightly longer (30.3–37.7,  $M = 34.2\%$  of head, *cf.* 28.0–34.8,  $M = 30.4\%$  in *H. tridens*), a difference emphasised visibly by the beaked premaxilla of *H. dolichorhynchus* compared with the narrow medial part of that bone in *H. tridens*. Although the range of length/breadth ratios for the lower jaw shows complete interspecific overlap, there is a marked difference in the specific modes, with the jaw consistently narrower in *H. tridens* (mode 2.8 times as long as broad, *cf.* 2.1 times in *H. dolichorhynchus*). In *H. tridens* the posterior tip of the maxilla generally extends to a point below the eye (often to one below the pupil), but in *H. dolichorhynchus* it does not even extend to below the anterior margin of the orbit; the mouth in *H. tridens* is usually less oblique than in *H. dolichorhynchus* (horizontal to *ca.* 10°, *cf.* 10°–20°, mode *ca.* 20°).

Unfortunately the live coloration of *H. tridens* is unknown, but the two species clearly differ in preserved coloration (*cf.* p. 37 above with p. 99 in Greenwood, 1967). *Haplochromis tridens* has no bars or longitudinal bands in either sex but all female *H. dolichorhynchus* show a longitudinal band (sometimes interrupted, sometimes faint) and vertical bars are present in males. Another difference is the very dark ventral pigmentation of adult male *H. dolichorhynchus* compared with the light grey-silver of *H. tridens*.

*Haplochromis dolichorhynchus* closely resembles *H. tyrianthinus*, a resemblance which extends to similarities in the live coloration of males. The principal diagnostic characters lie in the dentition and the slope of the head, but there are other, although less clear-cut, differences.

The outer teeth in *H. tyrianthinus* are slender and fine, with unicuspid teeth predominating. The cusp in these teeth is a little compressed, but the neck and body of the tooth are distinctly cylindrical in cross-section. In contrast the commonest tooth form in *H. dolichorhynchus* is the bicuspid; these teeth are slender but compressed both at the crown and in the body. Unicuspid teeth are rare in the outer tooth row of this species, and when present are more compressed than are the unicuspid teeth in *H. tyrianthinus*.



The dorsal head profile of *H. tyrianthinus* is more curved than in *H. dolichorhynchus*, and this feature, combined with a broader snout, gives *H. tyrianthinus* a more "heavy-headed" appearance than *H. dolichorhynchus*. Again, the distinctly beaked premaxilla of *H. dolichorhynchus* accentuates the impression of an elongate, sharp-pointed profile.

The orbit of *H. dolichorhynchus* is almost circular, that of *H. tyrianthinus* clearly longer than deep. The maxilla of *H. dolichorhynchus* does not reach the level of the anterior orbital margin, but in *H. tyrianthinus* it reaches that level or somewhat further posteriorly.

Although *H. dolichorhynchus* seems closely related to *H. chlorochrous*, superficially the two species are rather distinct. When alive they are immediately distinguishable: males of *H. dolichorhynchus* have a purple ground colour, those of *H. chlorochrous* a green one; females too are distinguishable on their coloration, being blueish-purple and lime-green in the species respectively.

Anatomically, the species may be separated by the broader snout of *H. chlorochrous* (0.9–1.0, mode 0.9 times as long as broad, cf. 1.0–1.4, mode 1.1 times), the more oblique lower jaw of *H. chlorochrous* and the less steeply inclined dorsal head profile of *H. dolichorhynchus*. The dentary of *H. chlorochrous* differs from that of *H. dolichorhynchus* in having the flare less pronounced and confined to the posterior and posterolateral parts of the bone (see p. 37 above). Finally, it may be noted that the neurocranium of *H. dolichorhynchus*, although essentially of the same type as that found in other species of the "tridens" group, differs in having the preorbital region somewhat more protracted.

The possible phyletic position of *H. dolichorhynchus* and other members of the "tridens" species complex will be discussed later (see p. 51).

#### STUDY MATERIAL AND DISTRIBUTION RECORDS

Museum and Reg. No.	Locality	Collector
	UGANDA	
B.M. (N.H.) 1968.8.30.168 (Holotype)	Murchison Bay (30 feet) . . . .	E.A.F.F.R.O.
B.M. (N.H.) 1968.8.30.191–196	Buvuma Channel, W. of Nienda and Vuga isls. (108 feet) . . . .	E.A.F.F.R.O.
B.M. (N.H.) 1968.8.30.177–190	North of Nsadzi isl. (70–100 feet) . . . .	E.A.F.F.R.O.
B.M. (N.H.) 1968.8.30.169–176	Murchison Bay (30 feet) . . . .	E.A.F.F.R.O.

#### *Haplochromis tyrianthinus* sp. nov.

(Text-figs. 25 and 26)

HOLOTYPE: an adult female 100.0 mm. S.L. (B.M. [N.H.] reg. no. 1968.8.30.135) from north of Nsadzi island.

The trivial name (from the Greek) refers to the predominantly purple colours of male fishes.

DESCRIPTION: based on 15 fishes (including the holotype), 85.0–105.0 mm. S.L.

Depth of body 27.3–32.6 (M = 30.6) % of standard length, length of head 32.2–35.0 (M = 33.7) %.



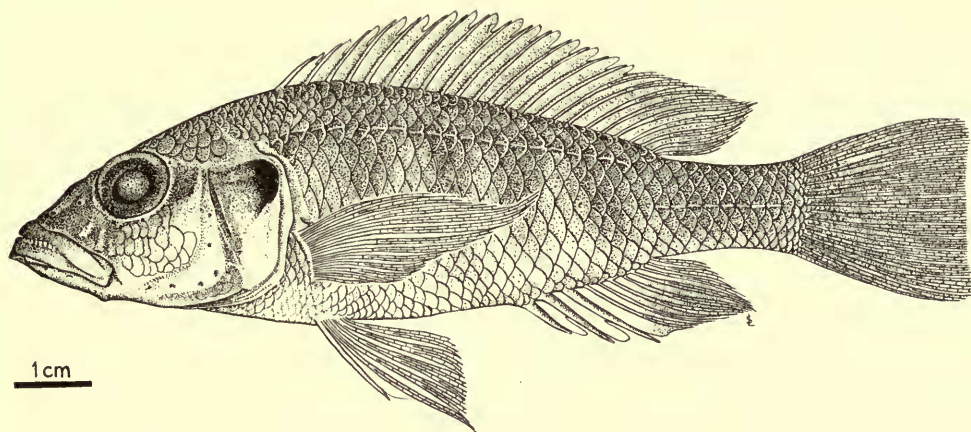


FIG. 25. *Haplochromis tyrianthinus*. Holotype. Drawn by Sharon Lesure.

Dorsal head profile slightly curved, sloping at an angle of  $30^{\circ}$ – $40^{\circ}$ ; premaxillary pedicels moderately prominent. Lateral line tubes and pores of the preorbital bone prominent.

Preorbital depth  $15.2$ – $18.3$  ( $M = 17.1$ ) % of head, least interorbital width  $15.2$ – $18.3$  ( $M = 17.4$ ) %. Snout  $0.9$ – $1.0$  (mode) times as long as broad, its length  $29.3$ – $35.2$  ( $M = 32.4$ ) % of head; snout length in this sample appears to show negative allometry with standard length. Orbit slightly elliptical (i.e. longer than deep), diameter of eye  $26.1$ – $29.3$  ( $M = 27.7$ ) % of head, depth of cheek  $20.0$ – $25.3$  ( $M = 22.9$ ) %.

Caudal peduncle  $16.2$ – $19.2$  ( $M = 18.1$ ) % of standard length,  $1.4$ – $1.9$  (modal range  $1.6$ – $1.8$ ) times as long as deep.

Mouth somewhat oblique, sloping at an angle of  $15^{\circ}$ – $20^{\circ}$  (mode); a horizontal line drawn from the upper anterior tip of the lower jaw passes below the orbit or less commonly through the lowermost part of the eye. Jaws equal anteriorly (rare) or the lower projecting slightly; lower jaw with a distinct but not prominent mental protuberance, its length  $44.3$ – $52.8$  ( $M = 47.5$ ) % of head, and  $1.7$ – $2.2$  (mode  $2.0$ ) times its breadth. Premaxilla somewhat expanded medially; posterior tip of maxilla reaching a vertical through the anterior orbital margin or to slightly beyond this point.

*Gill rakers*: 9 (mode) or 10 on the lower part of the first arch, the lower 1–3 rakers reduced, the upper 4 or 5 flattened with at least some anvil-shaped; the intervening rakers are of varied form (from short and stout to relatively long and slender) but none is flattened.

*Scales*: ctenoid; lateral line with 31 (f.2), 32 (f.2), 33 (f.8) or 34 (f.3) scales, cheek with 3 or 4 rows. Five to 6 (mode  $5\frac{1}{2}$ ) scales between the dorsal fin origin and the upper lateral line, 6–7 (mode 6) between the pectoral and pelvic fin bases.

*Fins*. Dorsal with 24 (f.11), 25 (f.3) or 26 (f.1) rays, comprising 14 (f.1), 15 (f.11) or 16 (f.3) spines and 8 (f.1), 9 (f.10) or 10 (f.4) branched rays. Anal with 11 (f.6) or 12 (f.9) rays comprising 3 spines and 8 or 9 branched rays. Pectorals  $25.7$ – $30.0$

( $M = 29.3$ ) % of standard length. Pelvics with the first ray produced in both sexes, but proportionately more so in adult males. Caudal truncate, scaled on its proximal half.

*Teeth.* The gently recurved *outer teeth* are slender, fine and nearly cylindrical in cross-section, but have slightly compressed crowns (Text-fig. 26). In the *upper jaw*, unicuspid, slenderly caniniform teeth predominate although slender bi- or weakly bicuspid teeth occasionally occur among the unicuspids in all parts of the row. The posterior outer teeth are sometimes tricuspid.

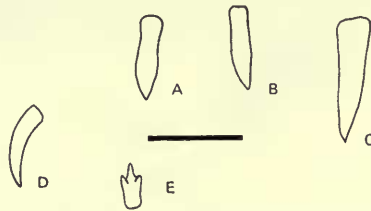


FIG. 26. *Haplochromis tyrianthinus*. A-D upper jaw teeth. A-C: in anterior view, D: in lateral view. Tooth C is from a larger individual than the other teeth. E: postero-lateral tooth from the dentary. Scale equals 1 mm.

In the lower jaw, the posterior teeth are generally tricuspid and slightly larger than their counterparts in the upper jaw. The posterolateral teeth can be an admixture of tri- and bicuspids, or bicuspids alone; a few fishes have unicuspids in this position. The other lower teeth in most individuals are slender unicuspids, but some bi- and weakly bicuspid teeth are sometimes found among the unicuspids.

There are 70-86 ( $M = 74$ ) teeth in the outer row of the upper jaw.

Most of the *inner teeth* are tricuspid, but in some fishes the outermost row is composed of slender unicuspids; very occasionally all the inner teeth are unicuspid. The median cusp of inner tricuspids is noticeably elongate.

All inner teeth are obliquely implanted, some lying almost horizontally; there are 2 or 3 (mode) rows in the upper jaw, and 2 (rarely 1 or 3) rows in the lower jaw.

*Osteology.* The *neurocranium* of *H. tyrianthinus* closely resembles that of *H. dolichorhynchus* (see p. 36) but is slightly less protracted in the preorbital region.

The dentigerous surface of the *premaxilla* is moderately expanded anteromedially but it is not so distinctly beaked as the premaxilla of *H. dolichorhynchus*; the pedicels are shorter than the dentigerous arms.

The *dentary* is flared like that of *H. dolichorhynchus* (see p. 37), and the short mental protuberance is moderately pronounced.

The toothed surface of the *lower pharyngeal bone* is slightly broader than long or, occasionally, equilateral. The teeth are cuspidate, relatively fine and usually rather widely spaced in from 24-36 rows; in some fishes, however, the teeth are finer, and more regularly and closely arranged in 30-36 rows.

*Coloration in life.* Detailed live colour notes are not available for this species but it was noted (J.M.G.) that adult males have a bright and intense purple coloration on the dorsal and lateral aspects of the body.

*Coloration of preserved material.* Adult males are brownish, lightest on the chest where a faint silver overlay is visible; the branchiostegal membrane is faintly grey. Very faint traces of 5 or 6 vertical bars are visible on the flanks and caudal peduncle, those over the body intergrade with the generally darker brown colour of the belly and ventral body region above and posterior to the anal fin. A faint lachrymal stripe is visible, being most intense immediately below the eye.

Dorsal, caudal and anal fins are grey, the lappets of the dorsal black, as is the membrane between the anal spines; the central region of the caudal fin is darker than the upper and lower parts. The pelvic fins are black.

*Females* are light brown above, shading to beige ventrally, and with faint traces of a silvery overlay on the chest and belly in some specimens. Very faint traces of about 5 broad vertical bars are visible on the flanks and caudal peduncle; the bars do not reach the ventral profile. In some specimens there is a faint midlateral dark stripe, most intense over the posterior half of the body. Dorsal, caudal and anal fins are greyish, the pelvics hyaline.

*Ecology. Habitat.* The species is known from only one locality, north of Nsadzi island. Specimens were obtained from a trawl fished over a mud bottom at a depth of 70–100 feet.

*Food.* One of the 10 guts examined was empty, one contained fragments of a small cichlid fish in the stomach and further fish remains in the intestine; the other 8 all yielded fragmentary remains of Crustacea (probably *Caridina* sp.). In only 2 guts was there any bottom detritus.

*Breeding.* Only one specimen (a female 85 mm. S.L.) is a juvenile; the smallest male (99 mm. S.L.) shows an advanced state of testicular development. There is no clear-cut indication of asymmetrical ovarian development.

*Diagnosis and affinities.* Within the “*tridens*” species complex, *H. tyrianthinus* most closely resembles *H. chlorochrous* and *H. dolichorhynchus*. Characters distinguishing *H. tyrianthinus* from the latter species (which it also resembles in live coloration) are discussed on p. 39. Live specimens (of either sex) are immediately distinguished from *H. chlorochrous* by their coloration which is basically purple to blue in *H. tyrianthinus* and green in *H. chlorochrous*.

Anatomically, *H. tyrianthinus* is distinguished from *H. chlorochrous* principally by dental characters and differences in head shape. The outer row of teeth in *H. tyrianthinus* is composed, mainly, of slender unicuspid, circular in cross-section over most of their length except for a slight compression of the crown. In *H. chlorochrous*, on the other hand, there is a mixture of bi- and unicuspid in this row, and the teeth although slender are relatively compressed, especially at the crown. There is also a difference in the pharyngeal teeth of the two species, but this character shows a greater degree of overlap than does the difference in jaw teeth. In most specimens of *H. tyrianthinus* the lower pharyngeal teeth are coarser, fewer and more widely spaced (particularly in the posterolateral corners of the dentigerous area) than are the teeth in *H. chlorochrous*. Small individuals of *H. tyrianthinus*, however, have a lower pharyngeal dentition like that of adult *H. chlorochrous*.

The lower jaw of *H. tyrianthinus* slopes less steeply than in *H. chlorochrous* ( $15^{\circ}$ – $25^{\circ}$ , mode  $20^{\circ}$ , cf.  $20^{\circ}$ – $35^{\circ}$ , mode  $30^{\circ}$ ); as a result, a horizontal drawn from the upper



tip of the lower jaw passes below the orbit (or through the lower orbital margin) in *H. tyrianthinus* but through the lower or middle part of the eye in *H. chlorochrous*.

The snout in *H. tyrianthinus* is somewhat narrower than in *H. chlorochrous* (0.9–1.0, mode 1.0, times as long as broad, cf. 0.9–1.0, mode 0.9, times in *H. chlorochrous*) and the dorsal head profile is gently curved, both factors contributing to the distinctly different physiognomy of the two species.

Osteologically, the principal interspecific differences lie in the more antero-posteriorly extensive and deeper flare of the outer face of the dentary in *H. tyrianthinus*.

*Haplochromis tyrianthinus* also resembles *H. tridens*, but is distinguished by its preserved coloration (especially the presence of vertical bars on the flanks) more oblique mouth, broader lower jaw (model length/breadth ratio 2.0 cf. 2.8 in *H. tridens*), less steeply declined and more curved upper head profile (30°–40°, cf. 40°–45° in *H. tridens*), and by its slender, predominantly unicuspid outer teeth.

The possible phyletic relationships of *H. tyrianthinus* are discussed on p. 51.

#### STUDY MATERIAL AND DISTRIBUTION RECORDS

Museum and Reg. No.	Locality	Collector
	UGANDA	
B.M. (N.H.) 1968.8.30.135 (Holotype)	North of Nsadzi isl. (70–100 feet)	E.A.F.F.R.O.
B.M. (N.H.) 1968.8.30.136–149	North of Nsadzi isl. (70–100 feet)	E.A.F.F.R.O.

#### *Haplochromis chlorochrous* sp. nov.

(Text-figs. 27–29)

HOLOTYPE: an adult male 102.5 mm. S.L. (B.M. [N.H.] reg. no. 1968.8.30.310) from water 70–100 feet deep between Nsadzi island and the mainland.

The trivial name (from the Greek) refers to the distinctive green colour of adult fishes.

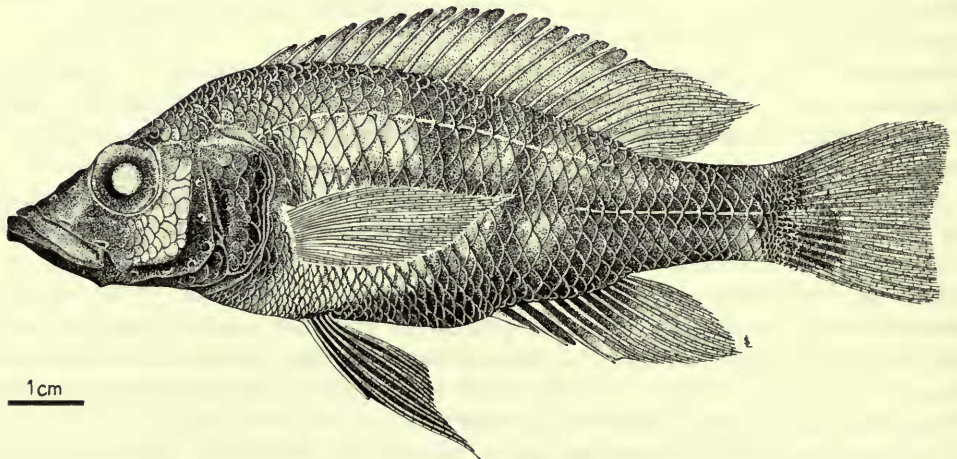


FIG. 27. *Haplochromis chlorochrous*. Holotype. Drawn by Sharon Lesure.



DESCRIPTION: based on 19 specimens (including the holotype), 70.0–120.0 mm. S.L.

Depth of body 29.5–34.5 ( $M = 32.0$ ) % of standard length, length of head 32.0–35.4 ( $M = 34.0$ ) %. Dorsal head profile straight or very slightly concave, sloping at an angle of 30°–40°; premaxillary pedicels only just apparent beneath the skin of the snout. Cephalic lateral line pores are prominent.

Preorbital depth 15.6–19.4 ( $M = 17.3$ ) % of head, least interorbital width 15.6–20.2 ( $M = 17.7$ ) %. Snout 0.9–1.0, mode 0.9 times as long as broad, its length 29.5–35.0 ( $M = 32.3$ ) % of head. Orbit slightly elliptical (i.e. longer than deep), diameter of eye 25.4–29.0 ( $M = 18.2$ ) % of head, depth of cheek 20.0–25.0 ( $M = 22.6$ ) %.

Caudal peduncle 15.4–20.3 ( $M = 18.2$ ) % of standard length, 1.3–1.9 (modal range 1.5–1.6) times as long as deep.

Mouth somewhat oblique (*ca.* 20°–35°, mode 30°); a horizontal line drawn from the upper tip of the lower jaw passes through the lower quarter of the eye or even through the centre of the eye. Lower jaw projecting, its length 44.3–51.8 ( $M = 47.0$ ) % of head, 1.6–2.1 (mode 1.9) times as long as broad; mental protuberance moderate. Premaxilla moderately expanded anteromedially. Posterior tip of the maxilla reaching a vertical through the anterior orbital margin or a little more posteriorly to below the eye.

*Gill rakers*: Nine or 10 (rarely 8), on the lower part of the first arch. The lower 1–4 rakers are reduced, the upper 3 or 4 flattened, sometimes lobed; intervening rakers are relatively short and stout.

*Scales*: ctenoid; lateral line with 31 (f.1), 32 (f.7), 33 (f.9) or 34 (f.1) scales, cheek with 3 or 4, rarely 5, rows. Five and a half to 6½ (mode 6) scales between the dorsal fin origin and the upper lateral line, 6–7 (mode), rarely 5, between the pectoral and pelvic fin bases.

*Fins*. Dorsal with 24 (f.17) or 25 (f.2) rays, comprising 14 (f.1), 15 (f.17), or 16 (f.1) spines and 9 (f.17) or 10 (f.2) branched rays. Anal with 11 (f.6) or 12 (f.13) rays, comprising 3 spines and 8 or 9 rays. Pectoral 26.8–30.4 ( $M = 28.7$ ) % of standard length. Pelvic fins with the first ray produced, not apparently showing any length correlation with sex, except that it is relatively longer in adults than in juveniles. Caudal truncate, scaled on its proximal half.

*Teeth*. In the *outer* tooth row of the *upper jaw* there is an admixture of slender unicuspid and slender, unequally bicuspid teeth, both types having relatively compressed crowns (Text-fig. 28); the bicuspid teeth may be so weakly cuspidate as to appear unicuspid. In the smallest fish (70 mm. S.L.) some tricuspid teeth are

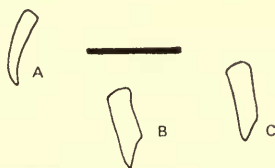


FIG. 28. *Haplochromis chlorochrous*. A–C upper jaw teeth. A: in lateral view. B and C: in anterior view. Scale equals 2 mm.

interspersed among the bicuspid. Posteriorly and posterolaterally the teeth are usually small and tricuspid, but in some specimens unicuspid or bicuspid are present in this position.

There are 66–86 ( $M = 74$ ) teeth in the outer row of the upper jaw.

Generally, the *outer teeth* in the *lower jaw* are similar to those in the upper jaw, but in a few fishes all except the posterior teeth are slender bicuspid. The posterior teeth are usually tricuspid and slightly larger than their counterparts in the upper jaw.

All teeth in the *inner rows* are tricuspid, and implanted somewhat obliquely. There are 2 or 3 (mode), rarely 4, rows in the upper jaw and 2 (mode) or 3, rarely a single row, in the lower jaw.

*Osteology.* The neurocranium of *H. chlorochrous* is indistinguishable from that of *H. tyrianthinus*, and premaxillary shape in the two species is also identical. The *dentary*, however, differs in that the flared region is restricted to a more posterior position (see p. 42). Consequently the anterior and anterolateral face of each ramus is almost flat, only the posterior and posterolateral faces showing any concavity. The mental protuberance is stout but not especially prominent.

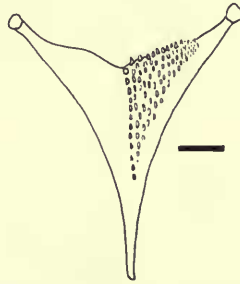


FIG. 29. *Haplochromis chlorochrous*. Lower pharyngeal bone. Scale equals 2 mm.

The dentigerous surface of the *lower pharyngeal bone* (Text-fig. 29) is as long as broad, or very slightly broader. The teeth are fine, cuspidate, and closely arranged in 30–36 regular rows.

*Coloration in life.* *Adult males* are dark green on the dorsal surfaces of the body and head, lighter green on the flanks which are crossed by 5 faint, dark, vertical bars; the ventral body surfaces are black.

Dorsal fin is greenish-yellow basally, hyaline distally, with faint traces of orange-red maculae. The caudal and pectoral fins greenish basally, hyaline distally. The anal is black basally, almost hyaline distally, the 2 or 3 ocelli are orange. Pelvic fins are black.

*Females* have the dorsal body surfaces lime-green, the flanks bright yellow, and the ventral body surfaces silver. There is a faint midlateral longitudinal stripe, and the flanks are crossed by 4 or 5 vertical bars. The head and upper lip are green, the lower lip yellow. All fins are yellowish-green.

*Preserved coloration.* *Adult males* have a yellow-brown ground coloration, the snout greyish, the lower jaw, ventral part of the preopercular region and the lower half of the operculum black. A broad and diffuse lachrymal stripe is usually visible.

The lower half of the body posterior to the vent is black or very dark brown; a narrow tongue of this dark area extends forward onto the ventral aspect of the belly as far as the base of the pelvic fins. Three to 5 dark vertical bars cross the posterior flanks; ventrally the bars merge with the black lower aspects of the body. A very faint, often incomplete, dark midlateral stripe is generally visible, extending forward from the dark posterior region almost to the opercular margin.

Dorsal fin dark grey, lappets and margin of the soft part black. The caudal fin is dark grey, indistinctly blotched with black near the base in some specimens, weakly maculate in others. Anal fin is black basally and between the spines, dark grey distally. The pelvic fins are black.

The single immature male is uniformly yellow-brown except for a darker snout region, faint lachrymal stripe, dusky lower jaw and preopercular region. The dorsal fin is grey with black lappets and margin to the soft part, the caudal and anal fins greyish, the anal dusky between the spines; the pelvics are dusky, becoming black over the anterior third.

*Females* have a light brown ground colour, darker dorsally and on the snout which is greyish in some individuals. A faint, narrow and interrupted dark midlateral stripe runs from behind the opercular margin to the base of the caudal fin where it is slightly expanded. The dorsal fin is greyish, the lappets black and the soft part entirely or partly maculate. Caudal fin grey, and indistinctly maculate. Anal hyaline, greyish along its margin in adults. Pelvic fins hyaline, but often greyish over the anterior third to half in adults.

*Ecology. Habitat.* All the specimens examined came from trawl hauls over a mud substrate, and at a depth of 70 to 100 feet, in the area between Nsadzi island and the mainland. One of us (J.M.G.) has recorded the species in several other localities, viz: south of Nsadzi island (130–160 feet, over mud), near Bulago island (55–75 feet, over mud), between the south side of Buvuma island and the northern shore of Bugaia island (105 feet, over mud) and between Mwama and Bugaia islands (200 feet, over mud).

*Food.* Two of the 15 guts examined were empty. Of the remainder, 2 contained only mud, and 11 mud with fragments of Crustacea (probably *Caridina* sp.).

*Breeding.* Three males (77, 78 and 89 mm. S.L.) are immature, as are 3 females (70, 72 and 74 mm. S.L.); all the larger fishes are adults. In the 7 adult females examined there is a distinct tendency for the right ovary to be larger than the left, irrespective of the individual's sexual state.

*Diagnosis and affinities.* *Haplochromis chlorochrous* is compared with *H. doli-chorhynchus* on p. 40, and with *H. tyrianthinus* on p. 43; in life its green coloration serves as an immediate diagnostic character.

From *H. tridens*, the fourth member of this species complex, *H. chlorochrous* is distinguished principally by its more oblique and broader lower jaw (angle of mouth 20°–35°, mode 30°, cf. horizontal to 10° in *H. tridens*; lower jaw 1.6–2.1, mode 1.9 times as long as broad, cf. 2.0–2.8, mode 2.8 times in *H. tridens*), and by the presence of vertical bars on the flanks of preserved adult males (a longitudinal stripe in females) as well as by the very dark ventral coloration on the posterior part of the body in males.



The possible phyletic relationships of *H. chlorochrous* are discussed on p. 51.

#### STUDY MATERIAL AND DISTRIBUTION RECORDS

Museum and Reg. No.	Locality	Collector
B.M. (N.H.) 1968.8.30.310 (Holotype)	Between Nsadzi isl. and mainland (70-100 feet)	E.A.F.F.R.O.
B.M. (N.H.) 1968.8.30.311-328	Between Nsadzi isl. and mainland (70-100 feet)	E.A.F.F.R.O.

UGANDA

#### *Haplochromis cryptogramma* sp. nov.

(Text-figs. 30 and 31)

HOLOTYPE: an adult male 86.5 mm. S.L. (B.M. [N.H.] reg. no. 1968.8.30.197) from the Bulago-Tavu bank at a depth of 50-75 feet.

The trivial name refers to the fancied resemblance of the midlateral longitudinal stripes to symbols in the Morse code.

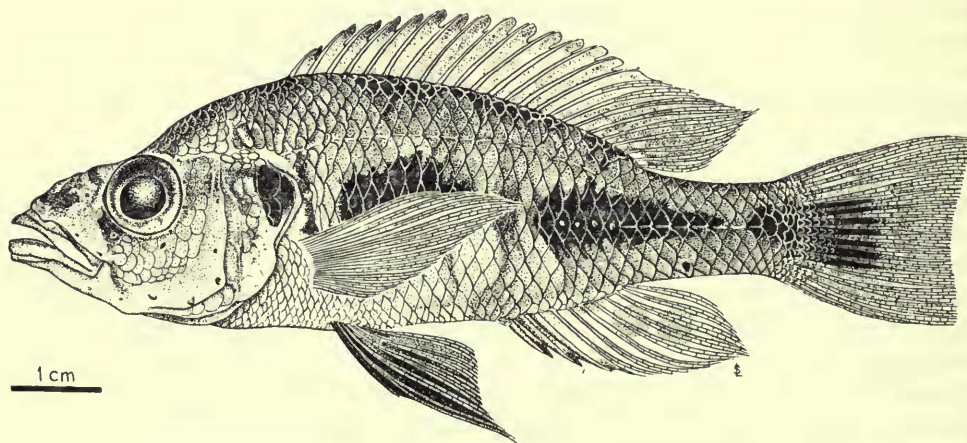


FIG. 30. *Haplochromis cryptogramma*. Holotype. Drawn by Sharon Lesure.

DESCRIPTION: based on 23 specimens (including the holotype) 55.0-94.0 mm. S.L. Depth of body 30.2-35.8 ( $M = 33.6$ ) % of standard length, length of head 34.5-38.8 ( $M = 35.7$ ) %.

Dorsal head profile sloping at an angle of 35°-40°, noticeably concave, the prominent premaxillary pedicels tending to exaggerate the concavity and giving the profile a characteristic outline (Text-fig. 30).

Preorbital depth 14.3-17.7 ( $M = 15.4$ ) % of head, least interorbital width 20.3-23.9 ( $M = 22.0$ ) %. Snout prominent in lateral view, 1.0-1.5 (mode 1.2) times as long as broad, its length 28.6-35.5 ( $M = 32.7$ ) % of head; eye diameter 25.8-31.6 ( $M = 28.7$ ) %, the orbit almost circular; depth of cheek 15.8-21.5 ( $M = 19.0$ ) %.



Caudal peduncle 17.5–22.7 ( $M = 19.2$ ) % of standard length, 1.5–2.0 (modal range 1.8–1.9) times as long as deep.

Mouth slightly oblique, sloping at an angle of  $10^{\circ}$ – $15^{\circ}$ . Jaws equal anteriorly or, less commonly, the lower projecting; premaxilla slightly expanded anteromedially. Lower jaw 40.0–48.5 ( $M = 44.8$ ) % of head, 2.0–2.7 (modal range 2.3–2.5) times as long as broad; mental protuberance slight. Posterior tip of the maxilla generally reaching a vertical through the anterior part of the orbit, but only to the anterior orbital margin in a few specimens.

*Gill rakers*: Eight or 9 (rarely 7 or 10) on the lower part of the first arch, the lower 2 or 3 rakers reduced, the remainder of varied form, from short and stout through slender to flattened with some of the upper rakers anvil-shaped.

*Scales*: ctenoid; lateral line with 31 (f.2), 32 (f.7) or 33 (f.8) scales (several specimens have lost their scales, hence these figures are derived from only 17 fishes); cheek with 3 rows (rarely 2 or 4). Five to  $6\frac{1}{2}$  (mode  $5\frac{1}{2}$ ) scales between the upper lateral line and the dorsal fin origin, 6–7 (mode 7) between the pectoral and pelvic fin bases.

*Fins*. Dorsal with 23 (f.5), 24 (f.17) or 25 (f.1) rays, comprising 15 (f.16) or 16 (f.7) spines and 8 (f.11) or 9 (f.12) branched rays. Anal with 10 (f.1), 11 (f.21) or 12 (f.1) rays, comprising 3 spines and 7–9 branched rays. Pectoral 25.0–32.0 ( $M = 28.3$ ) % of standard length. Pelvic fin with the first ray somewhat produced in both sexes, probable a little more so in adult males. Caudal truncate or slightly emarginate, scaled on its proximal half.

*Teeth*. The *outer row* of teeth in the *upper jaw* (except posteriorly) is composed mainly of unequally bicuspid, relatively stout teeth; however, most fishes have some tricuspid teeth interspersed amongst the bicuspids both anteriorly and laterally (Text-fig. 31). A few exceptional individuals have a predominance of tricuspid teeth in this row. Posteriorly and posterolaterally in this jaw there are either unicuspid and bicuspid teeth, or tricuspids alone; rarely, all three types of teeth occur in this position.

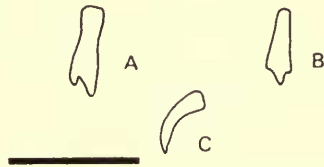


FIG. 31. *Haplochromis cryptogramma*. A–C upper jaw teeth. A and B: teeth from anterior part of outer row, in anterior view. C: tooth A in lateral view. Scale equals 2 mm.

There are 50–78 ( $M = 68$ ) teeth in the outer row of the upper jaw.

In the *lower jaw*, the teeth are similar to those in the upper jaw except that there are fewer tricuspids anteriorly and anterolaterally. Posteriorly and posterolaterally most fishes have tricuspid teeth, but in a few individuals the teeth in this position are bicuspid, or there is mixture of bi- and tricuspid teeth in this position.

The *inner series* is composed of obliquely implanted tricuspid teeth arranged in 2 or 3 rows in the upper jaw, and 1 or 2 rows in the lower jaw.

*Osteology.* The *neurocranium* of *H. cryptogramma* is essentially of the type found in the " *tridens* " species complex (*H. tridens*, *H. dolichorhynchus*, *H. tyrianthinus* and *H. chlorochrous*). It differs, however, in having a somewhat broader interorbital region and a lower supraoccipital crest.

The *premaxilla* is noticeably expanded medially and anteromedially, to give it a beaked appearance. The pedicels are longer than the dentigerous arms.

The *dentary* resembles that of *H. dolichorhynchus* because the lateral face is strongly flared and the resulting concavity extends forward almost to the symphyseal region. The lateral line system in the dentary shows no signs of hypertrophy.

The dentigerous surface of the *lower pharyngeal bone* is as broad as long or slightly broader than long. The teeth are relatively fine with, in some fishes, those of the median rows slightly coarser. A striking feature is the regularity with which the teeth are arranged in 26-30 rows.

*Coloration in life.* *Adult males* have the dorsal aspect of the head and body blueish-grey, shading to yellowish on the flanks, and silver ventrally. A reddish flush is usually present on the opercular and pectoral regions, and is most intense in ripe males. Two black bars cross the snout, and another, fainter, bar crosses the nuchal region behind the eyes. On the body there are 2 (but sometimes fused) black blotches at the dorsal fin base, and one on the dorsal part of the caudal peduncle. Midlaterally there is a prominent dark band interrupted in at least 2, often 3, places to give a series of short and long lines. The posterior line extends well onto the caudal fin. The dorsal fin is hyaline, with black lappets. The caudal fin is either colourless or, in ripe individuals, with a red flush. The anal is colourless or whiteish (especially in sexually active fishes) and has 2 or 3 yellow ocelli. The pelvic fins are uniformly black.

*Females* have a body coloration like that of males but are without the red flush; the cephalic and flank markings are present as in males, but the nuchal bar is usually less distinct. The caudal and anal fins are yellow, the other fins hyaline.

*Coloration in preserved material.* In *both sexes* the ground coloration is silvery white. A series of broad but elongate black blotches runs midlaterally along the flanks and caudal peduncle. The anterior (and shortest) blotch lies on the operculum, the posterior streak extends onto the caudal fin and may even reach to near the posterior border. A series of elongate blotches (sometimes confluent into 2 or even a single smudge) lies below the dorsal fin origin. In some fishes there are faint traces of 3 or 4 vertical bars on the flanks. The snout is crossed by 2 transverse bands and a faint nuchal bar is generally visible.

In *males* the dorsal fin is greyish, with black lappets, and a faintly sooty margin to the soft part; the anal is also greyish with black lappets, and faint off-white ocelli. The caudal is greyish to hyaline, somewhat darker basally and with an intense black blotch extending over at least the anterior half.

*Females* have all the fins hyaline but with a faint duskiess along the margin of the dorsal fin.

*Ecology. Habitat.* The species is known from 2 areas, namely, Namone point (at a depth of *ca.* 30 feet) and in the region of the Bulago-Tavu bank at a depth of 50-75 feet. In both areas the substrate is mud.

*Food.* The gut contents of 20 specimens (from one locality, near the Bulago-Tavu bank) were examined; of these, 4 were empty. The remainder all contained either pupal Diptera or adult Crustacea (especially *Caridina* sp.); less commonly, both types of food were present. In 8 guts, small quantities of bottom mud were also recorded.

*Breeding.* All the specimens examined (55-94 mm. S.L.) are adult. The right ovary is larger than the left in 6 of the 10 females available.

*Diagnosis and affinities.* The dentition and syncranial architecture of *H. cryptogramma* suggest close affinity with the "*tridens*" species complex (see p. 52). At the species level, however, *H. cryptogramma* is immediately distinguished from all other members of the group by the highly distinctive colour patterns in both live and preserved specimens.

*Haplochromis cryptogramma* is also distinguishable from other members of the "*tridens*" complex by its broader interorbital region.

Despite these differences we would include *H. cryptogramma* as a member of the "*tridens*" species group. Its phyletic position will, therefore, be discussed in relation to the rest of the group.

STUDY MATERIAL AND DISTRIBUTION RECORDS

Museum and Reg. No.	Locality	Collector
	UGANDA	
B.M. (N.H.) 1968.8.30.197 (Holotype)	Bulago-Tuva bank (50-75 feet)	E.A.F.F.R.O.
B.M. (N.H.) 1968.8.30.198-214	Bulago-Tavu bank (50-75 feet)	E.A.F.F.R.O.
B.M. (N.H.) 1968.8.30.215-219	Namone Point (Hannington Bay) (ca. 30 feet)	E.A.F.F.R.O.

The affinities of the *H. tridens* species group

The discovery of *H. dolichorhynchus*, *H. tyrianthinus*, *H. chlorochrous* and *H. cryptogramma* considerably modifies Greenwood's (1967) remarks about the affinities of *H. tridens*. That species was thought to occupy an isolated position among the Lake Victoria species flock, but the new species show that there is, in fact, a group of at least 5 "*tridens*"-like species.

All are characterized by their dentition, general facies and syncranial architecture (see above in the relevant sections of the species' descriptions). Although these various characters provide a means of delimiting the group as a whole, there still remains the problem of its relationships with other species complexes.

The unusual dental characteristic of the "*tridens*" group lies in the high proportion of tricuspid teeth in the outer tooth row of both jaws. The morphology of the non-tricuspid teeth is not outstanding; similar teeth occur in many other species-groups (except, of course, the most generalized) and are common types in the "*prognathus*" complex of piscivorous species (see Greenwood, 1967, p. 109).

The body-form in the "*tridens*" complex also occurs in the "*prognathus*" group, as does their type of syncranial morphology and organization. Indeed, the neurocranium of *H. dolichorhynchus* is very like that of *H. prognathus* itself, and the neurocranium in other group members does not depart greatly from this type.



These various similarities suggest to us that the "*tridens*" species complex is derived from the same stem as the "*prognathus*" group, and probably from an ancestor resembling the present-day *H. prognathus*.

The 4 species described in this paper, together with *H. tridens*, form a close-knit complex in which *H. cryptogramma* is the most deviant member, at least in its superficial appearance. But, if *H. arcanus* (see p. 54) is to be included in the "*tridens*" complex, it would qualify for that position. For the moment, however, we would prefer to leave open the question of the affinities of *H. arcanus*.

***Haplochromis arcanus* sp. nov.**

(Text-fig. 32)

HOLOTYPE: an adult male 127.0 mm. S.L. (B.M. [N.H.] reg. no. 1968.8.30.19) from south of Nsadzi island, at a depth of between 130-160 feet.

The trivial name (from the Latin for secret) refers to our uncertainty about the relationships of this species within the Lake Victoria *Haplochromis* species-flock.

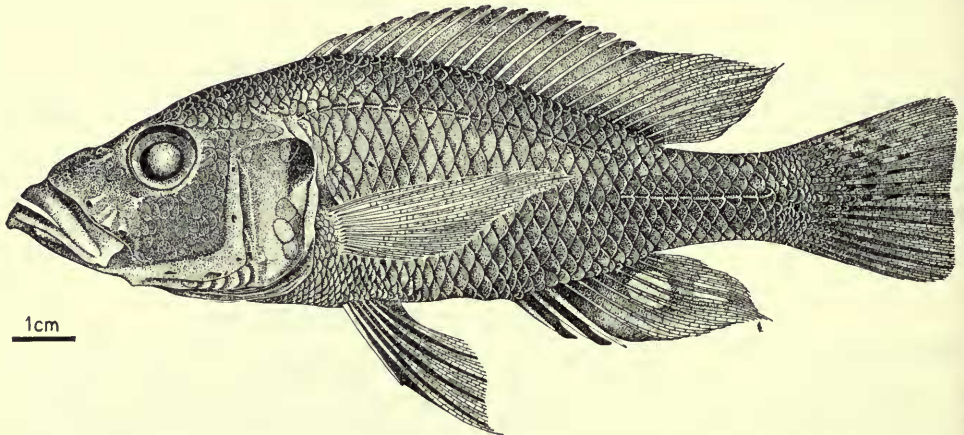


FIG. 32. *Haplochromis arcanus*. Holotype. Drawn by Sharon Lesure.

DESCRIPTION: based on 9 specimens (including the holotype) 104.0-142.0 mm. S.L. Depth of Body 30.8-33.3 ( $M = 31.9$ ) % of standard length, length of head 37.3-39.4 ( $M = 38.1$ ) %.

Dorsal head profile almost straight (but with a slight supraorbital depression which is intensified by the prominent premaxillary pedicels), sloping at an angle of 30°-35°.

Preorbital depth 17.3-19.8 ( $M = 18.8$ ) % of head, least interorbital width 16.6-19.2 ( $M = 18.1$ ) %. Snout 1.1-1.4 (mode 1.2) times as long as broad, its length 33.8-38.5 ( $M = 35.7$ ) % of head, eye diameter 22.7-25.0 ( $M = 24.1$ ), depth of cheek 22.2-26.0 ( $M = 23.8$ ) %.

Caudal peduncle 13.7-18.3 ( $M = 16.0$ ) % of standard length, 1.3-1.7 (mode 1.5) times as long as deep.

Mouth moderately oblique, sloping at an angle of 30°-35°; lower jaw with a distinct mental protuberance, projecting slightly, its length 47.0-51.8 ( $M = 49.3$ ) %



of head, 1.9–2.2 (mode 2.1) times as long as broad. Premaxilla somewhat expanded anteromedially and thus slightly beaked. Posterior tip of the maxilla reaching a vertical slightly anterior to the orbital margin, or one reaching the orbit.

*Gill rakers*: 9–11 (mode 10) on the anterior part of the first gill arch, the lower 1–3 rakers reduced, the upper 3 or 4 flattened, expanded and often anvil-shaped; the intervening rakers are relatively stout.

*Scales*: ctenoid; lateral line with 31 (f.1), 32 (f.5), 33 (f.1) or 34 (f.2) scales, cheek with 4 (mode) or 5 rows. Six to 7 (mode 6) scales between the upper lateral line and the dorsal fin origin, 7–8 (mode), rarely 6, between the pectoral and pelvic fin bases.

*Fins*. Dorsal with 24 (f.5) or 25 (f.4) rays, comprising 14 (f.1), 15 (f.7) or 16 (f.1) spines and 9 (f.5) or 10 (f.4) branched rays. Anal with 11 (f.4), 12 (f.3) or 13 (f.2) rays, comprising 3 spines and 8–10 branched rays. Pectoral fin 26.2–31.7 ( $M = 30.0$ ) % of standard length. Pelvics with the first ray produced. Caudal truncate, scaled on its basal half.

*Teeth*. Except in the smallest specimen (104 mm. S.L.), the *outer teeth* in both jaws are slender and unicuspid, those situated anteriorly and laterally in both jaws slightly recurved, but the posterolateral and posterior upper teeth strongly incurved.

The smallest fish has an admixture of weakly bicuspid and unicuspid teeth, and the posterolateral upper teeth are not strongly incurved.

There are 50–74 ( $M = 64$ ) outer teeth in the upper jaw.

The *inner teeth* in most specimens are all tricuspid, but in a few individuals there is an admixture of uni- and bicuspid, with unicuspid predominating in the lower jaw. There are 2 or 3 rows of inner teeth in the upper jaw, and 2 rows in the lower jaw, all implanted at a slight angle.

*Osteology*. No complete skeleton of *H. arcanus* is available.

The *lower pharyngeal bone* has a triangular dentigerous surface which is as broad as, or slightly broader than, long. The teeth are fine, compressed and cuspidate, and are arranged in 26–30 rows. In some fishes the posterior teeth in the 2 median rows are noticeably coarser than their anterior congeners.

*Coloration*. The colours of live fishes are unknown.

*Preserved material*. *Males (adult)* have dark, yellowish-brown ground coloration with a faint duskiess on the chest and belly. The dorsal head surface and the snout are dusky, the branchiostegal membrane dusky in the opercular region but dark brown anteriorly. The dorsal fin is dusky, but with a darker basal region and black lappets. The caudal fin is very dark grey (almost black basally) with black maculae over most of its surface, the spots most concentrated on the upper half. Anal fin dark grey, dusky along its base and over the spinous part; ocelli large, lighter grey than the fin membrane but with a dark ring surrounding each ocellus. The pelvic fins are black.

*Females (adult)* have a greyish-yellow ground coloration dorsally, shading to light yellow-brown on the chest and belly; the snout and dorsal head surfaces dark grey. The dorsal fin is greyish with black lappets. Caudal fin greyish (darkest basally) with some dark maculae on the upper half. Anal hyaline or hyaline with a dark band

basally and another slightly below the distal margin. Pelvic fins hyaline or with a faint dusky marbling.

*Ecology. Habitat.* The species is known from only 2 localities; one, south of Nsadzi island at a depth of 130–160 feet over a mud bottom, the other north of Nsadzi island, also over a mud bottom but at a depth of 70–100 feet.

*Food.* No information is available; the guts examined were empty, and several specimens had been eviscerated before preservation.

*Breeding.* All 9 specimens are adult.

*Diagnosis and affinities.* At present we can say little about the affinities of *H. arcanus*. Superficially, the species resembles certain members of the “*tridens*” complex, particularly *H. tyrianthinus* and *H. dolichorhynchus*. However, it differs from all members of the “*tridens*” group in being without any tricuspid teeth in the outer tooth row of either jaw, and in having the posterolateral upper teeth strongly incurved.

*Haplochromis arcanus* also differs from *H. tyrianthinus* in head shape (especially the prominent premaxillary pedicels), its longer head (37.3–39.4,  $M = 38.1\%$  S.L., *cf.* 32.2–35.0,  $M = 33.7\%$ ), narrower snout (1.1–1.4, mode 1.2 times as long as broad, *cf.* 0.9–1.0, mode 1.0 times) and in having fewer and stouter teeth (this in addition to the dental differences noted above).

From *H. dolichorhynchus*, *Haplochromis arcanus* differs in having a slightly longer head, a markedly different profile (including a more oblique lower jaw) and in various dental details (especially the unicuspid and recurved outer teeth, the relatively stouter form of all outer teeth and their greater spacing).

The dentition of *H. arcanus* resembles that of *H. argenteus*, and there is a fairly close similarity in general facies, especially when specimens of comparable size are examined (see Greenwood, 1967, p. 84). *Haplochromis arcanus* differs from *H. argenteus* in having a larger eye (22.7–25.0,  $M = 24.1\%$  of head, *cf.* 19.4–23.5,  $M = 21.5\%$ ), broader lower jaw (1.9–2.2, mode 2.1 times as long as broad, *cf.* 2.3–3.1, modal range 2.8–3.0 times in *H. argenteus*), a longer pectoral fin (26.2–31.7,  $M = 30.0\%$  S.L., *cf.* 24.1–29.7,  $M = 25.0\%$ ), and smaller chest and nape scales (see Greenwood, *op. cit.*).

On the characters we have been able to study (and these exclude osteological ones), *H. arcanus* could be related to either the *H. tridens* species complex, or to *H. argenteus*. Since both the “*tridens*” group and *H. argenteus* are probably derived from an *H. prognathus*-like ancestor (see above, p. 51, and Greenwood, *op. cit.*) these bilateral affinities of *H. arcanus* would not be unexpected if it too is descended from a similar stem.

#### STUDY MATERIAL AND DISTRIBUTION RECORDS

Museum and Reg. No.	Locality	Collector
UGANDA		
B.M. (N.H.) 1968.8.30.19 (Holotype)	S. of Nsadzi isl. (130–160 feet)	E.A.F.F.R.O.
B.M. (N.H.) 1968.8.30.22–27	S. of Nsadzi isl. (130–160 feet)	E.A.F.F.R.O.
B.M. (N.H.) 1968.8.30.20–21	N. of Nsadzi isl. (70–100 feet)	E.A.F.F.R.O.

*Haplochromis decticrostoma* sp. nov.

HOLOTYPE: an adult male 199.0 mm. S.L. (B.M. [N.H.] reg. no. 1968.8.30.292) from south of Nsadzi island, at a depth of 180 feet.

The trivial name (from the Greek *dektikos*: able to bite, and *stoma*: mouth) refers to the large mouth.

DESCRIPTION: based on 22 specimens (including the holotype), 129.0–229.0 mm. S.L.

Depth of body 32.9–40.1 (M = 36.6) % of standard length, length of head 36.1–42.0 (M = 38.9) %.

Dorsal head profile straight, sloping at an angle of 30°–35°, usually interrupted by the premaxillary pedicels. Pores of the cephalic lateral line system are fairly prominent, especially those on the preorbital which has a swollen appearance.

Preorbital depth 19.4–23.8 (M = 21.7) % of head length, least interorbital width 20.0–23.1 (M = 21.6) %. Snout 1.0–1.2 (mode 1.1) times as long as broad, its length 37.1–41.0 (M = 38.9) % of head. Eye diameter 17.9–22.6 (M = 20.1) % of head, eye/preorbital ratio 0.8–1.0 (mode 0.9); depth of cheek 26.4–31.3 (M = 29.1) %.

Caudal peduncle 14.4–18.7 (M = 16.4) % of standard length, 1.2–1.7 (mode 1.4) times as long as deep.

Mouth oblique, sloping at an angle of 30°–40°, lower jaw projecting slightly to strongly, its length 50.7–55.7 (M = 53.0) % of head, 1.6–2.3 (modal range 1.9–2.0) times as long as broad. A very prominent mental protuberance is developed, apparently a little longer in males than in females (but this point requires further checking on more specimens). Posterior tip of the maxilla reaching a vertical through a point slightly nearer the orbit than the nostril, or less frequently, somewhat more posteriorly, but never reaching a vertical through the anterior orbital margin.

*Gill rakers*: Nine or 10 (mode) on the lower part of the first gill arch, the lower 1–3 rakers reduced, the remainder short and stout, or relatively stout.

*Scales*: ctenoid; lateral line with 32 (f.9) or 33 (f.12) scales, cheek with 5 or 6 (mode 5) rows. Six and a half to 8 (mode 7½) scales between the upper lateral line and the dorsal fin origin, 6 (rarely) to 8 (mode) between the pectoral and pelvic fin bases.

*Fins*. Dorsal with 23 (f.1), 24 (f.9) or 25 (f.10) rays, comprising 14 (f.1), 15 (f.16), or 16 (f.3) spines and 9 (f.13) or 10 (f.7) branched rays. Anal with 11 (f.1), 12 (f.16) or 13 (f.3) rays, comprising 3 spines and 8–10 branched rays. Pectoral 27.4–34.8 (M = 29.7) % of standard length. Caudal fin truncate, scaled on its proximal half. Pelvics with the first ray produced, proportionately more so in males than in females.

*Teeth*. The *outer teeth* in *both jaws* are unicuspid, long, and relatively curved, especially over the distal half. There are 56–80 (M = 68) teeth in the outer row of the upper jaw.

The inner teeth are also unicuspid and curved, and are implanted obliquely, especially in the upper jaw where they lie almost horizontally. The inner teeth are arranged rather irregularly in 3 or 4 rows in the upper jaw and in 2 or 3 rows in the lower jaw.



*Osteology.* The syncranium of *H. decticostoma* is very similar to that of *H. spekkii* in most details. One possible interspecific difference in the neurocranium, the height and basal extent of the supraoccipital crest, cannot be substantiated without more osteological material of both species. Another probable difference is the more gently sloping preorbital profile in the skull of *H. decticostoma*.

The lower pharyngeal bone has a triangular dentigerous surface, as long as broad or somewhat broader (1.1–1.2 times). The lower pharyngeal teeth are fine, compressed and cuspidate, and are arranged in 24–28 irregular rows; teeth in the 2 median series are generally coarser than their lateral congeners.

*Coloration in life.* Males have a dark golden-brown ground coloration, the dorsal surfaces darkest and with iridescent blue highlights, shading to silver ventrally; an iridescent greenish to yellowish sheen extends over the flanks, opercular region and the cheeks.

Dorsal fin hyaline, darker (almost grey) proximally, lappets dark, soft part with orange-red streaks and spots. Anal hyaline but with a maroon flush distally, and with several orange ocelli (sometimes arranged in 2 rows). Caudal dark proximally, hyaline distally, with orange or red streaks and spots between the rays. Pelvic fins dusky.

*Females.* Except for the hyaline fins and absence of anal ocelli, the live coloration of females is like that of males.

*Preserved material.* Males have a brownish-grey coloration dorsally, becoming silver-grey on the ventral surfaces. The snout and preorbital region are dark grey, as are the lips and tip of the lower jaw (the latter almost black in some specimens). The cheek and opercular region are yellowish, the branchiostegal membrane yellowish to dead-white. In some specimens there is a very faint, narrow, but dark midlateral stripe separating the darker dorsal coloration from the lighter ventral tones; a very faint lachrymal stripe is visible in some fishes, being most intense near the angle of the jaws.

Dorsal fin greyish with dark lappets. Anal greyish basally, becoming hyaline distally, the numerous ocelli large and dead-white but sometimes with a faint grey overlay. Caudal greyish, with darker maculae. Pelvic fins dusky to black, the colour most intense on the anterior half of the fin.

*Females* are light yellowish-brown above, shading to yellowish-white on the chest and belly. The snout, upper lip and tip of the lower jaw are dusky grey, the cheek and opercular region yellowish. A faint dark spot situated behind the angle of the jaw seems to be comparable with the more intense part of the lachrymal stripe in males.

Dorsal fin greyish-hyaline, the lappets dusky. Anal and pelvic fins hyaline, the caudal greyish with darker maculae on its proximal half.

*Ecology. Habitat.* The specimens examined came from trawl hauls in 2 localities near Nsadzi island. In both places the bottom is of mud and the depth of water between 70 and 180 feet.

*Food.* All the 25 specimens examined had been almost completely eviscerated by pressure change during capture, and in 16 of these specimens the remaining gut was empty. In the other 9 fishes at least part of the gut was intact and contained food,



namely: remains of *Caridina* sp. (Crustacea) in 5 specimens, very fragmentary and unidentifiable fish remains in 3, and a mixture of fish and crustaceans (probably *Caridina* sp.) in one other.

*Breeding.* All except one of the 25 specimens examined (129–229 mm. S.L.) are adult. The exceptional fish is an immature female 150 mm. S.L. (It should be noted that a female 129 mm. S.L. is adult.)

*Diagnosis and affinities.* In all respects, *H. dectocostoma* is very similar to *H. spekii* (see Greenwood, 1967).

Unfortunately, the live colours of *H. spekii* are unknown. But, judging from *post-mortem* coloration, *H. spekii* differs from *H. dectocostoma* in having a darker, more generally blue-grey ground coloration, and a dark (probably black) branchiostegal membrane. The preserved coloration of both species is similar, but again adult male *H. spekii* are darker and the branchiostegal membrane in *H. dectocostoma* is lighter.

On most morphometric criteria the two species are indistinguishable. The lower jaw of *H. dectocostoma* is more oblique than in *H. spekii* ( $30^{\circ}$ – $40^{\circ}$ , mode  $35^{\circ}$ , cf. horizontal to ca.  $15^{\circ}$ ), and the posterior tip of the maxilla does not extend quite so far posteriorly (but there is some overlap interspecifically in this character).

The modal number of gill rakers in *H. dectocostoma* is higher (10 cf. 8), but the ranges overlap.

The least interorbital width in *H. dectocostoma* is slightly narrower than in *H. spekii* (20.0–23.1,  $M = 21.6\%$  head, cf. 22.0–26.0,  $M = 23.3\%$  in *H. spekii*), and the mean eye/preorbital ratio is lower (0.8–1.0,  $M = 0.9$ , cf. 0.8–1.3,  $M = 1.0$ ).

*Haplochromis dectocostoma* also resembles *H. serranus* (see Greenwood, 1967, for a discussion of the *H. serranus*–*H. spekii* relationship, and Greenwood, 1962, for *H. serranus*). The resemblance includes an oblique lower jaw, but the species differ in such characters as their preserved coloration, the higher number of gill rakers in *H. dectocostoma* (10, cf. 8 or 9 in *H. serranus*), its deeper preorbital (19.4–23.8,  $M = 21.7\%$  head, cf. 14.6–20.0,  $M = 17.7\%$  in *H. serranus*), and its lower eye/preorbital ratio (0.8–1.0,  $M = 0.9$ , cf. 1.1–1.5,  $M = 1.3$ ).

Phyletically, *H. dectocostoma* is a derivative of the *H. serranus* stem, and probably from a species anatomically indistinguishable from *H. spekii*.

#### STUDY MATERIAL AND DISTRIBUTION RECORDS

Museum and Reg. No.	Locality	Collector
UGANDA		
B.M. (N.H.) 1968.8.30.292 (Holotype)	S. of Nsadzi isl. (180 feet)	E.A.F.F.R.O.
B.M. (N.H.) 1968.8.30.302–309	N. and S. of Nsadzi isl. (70–160 feet)	E.A.F.F.R.O.
B.M. (N.H.) 1968.8.30.293–301	S. of Nsadzi isl. (180 feet)	E.A.F.F.R.O.
B.M. (N.H.) 1968.8.30.330–333	S. of Nsadzi isl. (180 feet)	E.A.F.F.R.O.

#### *Haplochromis gilberti* sp. nov.

(Text-fig. 33)

HOLOTYPE: an adult male 151.0 mm. S.L. (B.M. [N.H.] reg. no. 1968.8.30.1) from near Bulago island.

The species is named in honour of Mr. Michael Gilbert, Experimental Fisheries Officer of the East African Freshwater Fisheries Research Organization. Michael Gilbert's enthusiasm and skill have added considerably to our knowledge of the Lake Victoria fishes, and especially the *Haplochromis* species from the deeper waters.

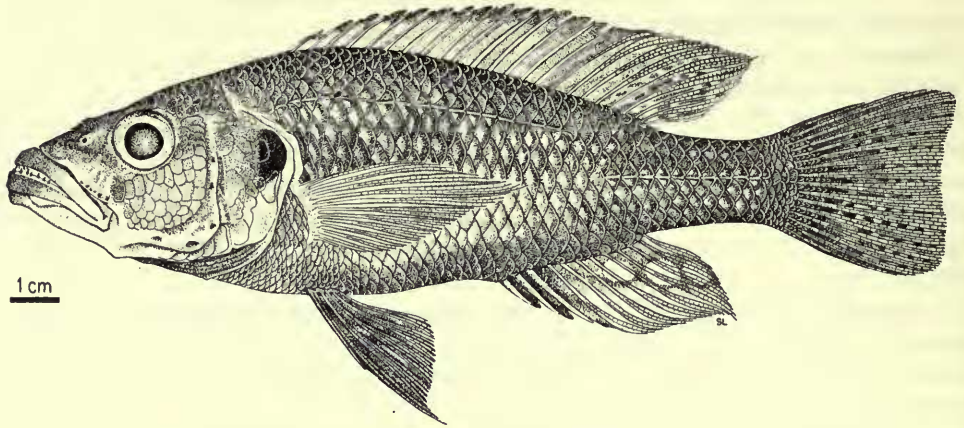


FIG. 33. *Haplochromis gilberti*. Holotype. Drawn by Sharon Lesure.

DESCRIPTION: based on 12 specimens (including the holotype) 125.0–150.0 mm. S.L. Depth of body 30.6–34.7 ( $M = 32.3$ ) % of standard length, length of head 34.3–37.5 ( $M = 36.0$ ) %.

Dorsal head profile straight or very slightly curved, sloping at an angle of 25°–30°, its contour interrupted by the prominent premaxillary pedicels.

Preorbital depth 16.3–19.2 ( $M = 17.8$ ) % of head, least interorbital width 17.0–19.6 ( $M = 18.1$ ) %. Snout 1.0 (mode)–1.1 times as long as broad, its length 32.6–36.2 ( $M = 34.4$ ) % of head, diameter of eye 23.0–27.5 ( $M = 24.8$ ), depth of cheek 22.2–25.3 ( $M = 23.7$ ) %.

Caudal peduncle 15.4–17.3 ( $M = 16.6$ ) % of standard length, 1.4–1.6 times as long as deep.

Mouth slightly oblique (*ca.* 25°), jaws equal anteriorly or the lower projecting slightly. Lower jaw length 44.3–49.1 ( $M = 47.5$ ) % of head, 1.9–2.3 (mode 2.0) times as long as broad; a distinct but low mental protuberance is developed. Pre-maxilla with its dentigerous surface somewhat expanded medially and anteromedially giving a slightly beaked effect. Posterior tip of the maxilla reaching a vertical through the anterior orbital margin or slightly beyond, rarely not quite reaching the level of the orbit.

*Gill rakers*: Nine (rarely 8 or 10) on the lower part of the first gill arch, the lower 1–3 rakers reduced, the upper 3–6 (usually 4) flattened, often anvil-shaped; the intervening rakers of varied shape, from relatively slender to relatively stout.

*Scales*: ctenoid. Lateral line with 32 (f.2) or 33 (f.9) scales; cheek with 3 or 4 rows. Five and a half (rarely) to 7 (mode 6½) scales between the upper lateral line and the dorsal fin origin, 6 or 7 between the pectoral and pelvic fin bases.

*Fins.* Dorsal with 24 (f.5) or 25 (f.7) rays, comprising 15 spines and 9 or 10 branched rays. Anal with 11 (f.1) or 12 (f.11) rays, comprising 3 spines and 8 or 9 branched rays. Pectoral 24.0–29.9 ( $M = 27.8$ ) % of standard length. Caudal truncate, scaled on its proximal half. Pelvics with the first ray produced (only one female is available).

*Teeth.* The *outer teeth* in *both jaws* are long, slender unicuspid, recurved distally. These teeth are well-spaced with 38–50 ( $M = 40$ ) in the upper jaw.

The *inner teeth* are also unicuspid and curved, and are implanted obliquely, those of the lower jaw lying almost horizontally. There 3 or 4 irregular series of inner teeth in the upper jaw, and 2 or 3 series in the lower jaw.

*Osteology.* The *neurocranium* of *H. gilberti* is moderately elongate and slender, and except for its greater width across the interorbital region, resembles the type found in *H. tyrianthinus* and other members of the "*tridens*" species complex (see p. 51). Thus in general the skull of *H. gilberti* approaches the "*prognathus*" skull type (see Greenwood, 1967, p. 109 *et. seq.*). The cephalic lateral line tubes are moderately hypertrophied, with enlarged pores.

The *premaxilla* is moderately beaked. Together with the *dentary*, these bones can be considered typical of the condition found in many "*prognathus*"-group species.

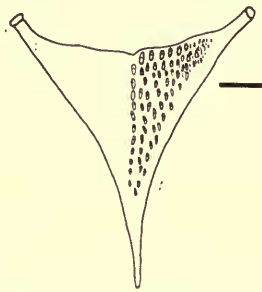


FIG. 34. *Haplochromis gilberti*. Lower pharyngeal bone. Scale equals 2 mm.

The *lower pharyngeal bone* (Text-fig. 34) is moderately slender, with its triangular dentigerous surface as long as broad. The teeth are coarse but compressed and cuspidate, and are arranged in 22–28 rows.

*Coloration.* The colours of live fishes are unknown.

*Preserved material.* *Adult males* are brownish-grey above the upper lateral line, on the dorsal surface of the head, the snout and the cheeks; silvery-grey below, the silver sheen most intense on the chest, belly and the operculum. The branchiostegal membrane is brownish, except for a faint dusky overlay in the opercular region of some individuals. In certain specimens there is a faint, dark lachrymal stripe, and faint traces of a dark midlateral longitudinal band.

The dorsal fin is dusky grey, the lappets black, the soft part with dark maculae. Caudal greyish, lighter along the posterior margin, the entire fin darkly maculate. Anal fin yellowish-hyaline, with a narrow, dusky base; the ocelli are large and dead-white. Pelvic fins are black.



*Female* (the only specimen available, an adult). Ground colour brownish grey above the upper lateral line, shading to silver below that level; a faint midlateral longitudinal stripe is visible on the flanks and caudal peduncle. The snout is greyish, the cheeks silvery, the branchiostegal membrane yellowish-white.

The dorsal fin is dark hyaline, as is the caudal which, however, is dusky at its base. The anal and pelvic fins are hyaline.

*Ecology. Habitat.* The species is so far known from only one locality, near Bulago island at a depth of 55–75 feet over a mud bottom.

*Food.* Two of the 12 guts examined were empty; of the others, 2 contained fragmentary remains of small cyprinid fishes, 1 unidentifiable fish remains, 2 fragmentary fish (cyprinid) and insect remains (chironomid pupae), 4 contained only fragments of chironomid pupae, and 1 an unidentifiable, colourless solid.

*Breeding.* Except for the single adult female (146 mm. S.L.), all the other specimens are adult males. The right ovary of the female is noticeably larger than the left one.

*Diagnosis and affinities.* Superficially (and in most aspects of its anatomy) *H. gilberti* resembles *H. paraguayarti* (see Greenwood, 1967, p. 69) and was probably derived from the same stem as that species. *Haplochromis gilberti* differs from *H. paraguayarti* principally in having a narrower interorbital (17.0–19.6,  $M = 18.1\%$  of head, cf. 22.9–27.7,  $M = 25.3\%$ ) and a lower mean number of outer teeth in the upper jaw (38–50,  $M = 40$ , cf. 42–62,  $M = 54$  in *H. paraguayarti*); the outer teeth in *H. gilberti* are also more slender than those of *H. paraguayarti*.

#### STUDY MATERIAL AND DISTRIBUTION RECORDS

Museum and Reg. No.	Locality	Collector
	UGANDA	
B.M. (N.H.) 1968.8.30.1 (Holotype)	Near Bulago isl. (55–75 feet)	E.A.F.F.R.O.
B.M. (N.H.) 1968.8.30.2–12	Near Bulago isl. (55–75 feet)	E.A.F.F.R.O.

#### *Haplochromis paraplagiostoma* sp. nov.

(Text-fig. 35)

**HOLOTYPE:** an adult female 97.0 mm. S.L. (B.M. [N.H.] reg. no. 1968.8.30.127) from west of Bulago island, at a depth of 70 feet.

**DESCRIPTION:** based on 8 specimens (including the holotype) 90.5–98.0 mm. standard length.

Depth of body 34.1–38.7 ( $M = 35.9$ ) % of standard length, length of head 31.9–33.4 ( $M = 32.0$ ) %.

Dorsal head profile sloping at an angle of 35°–40°, almost straight but gently curved in the nuchal region, and with a slight supraorbital concavity.

Preorbital depth 15.5–18.7 ( $M = 17.1$ ) % of head, least interorbital width 19.0–22.6 ( $M = 20.9$ ) %. Snout 1.1–1.3 (mode 1.2) times as broad as long, its length 29.0–31.8 ( $M = 30.2$ ) % of head, diameter of eye 24.1–29.0 ( $M = 26.5$ ), depth of cheek 25.1–29.0 ( $M = 27.3$ ) %.



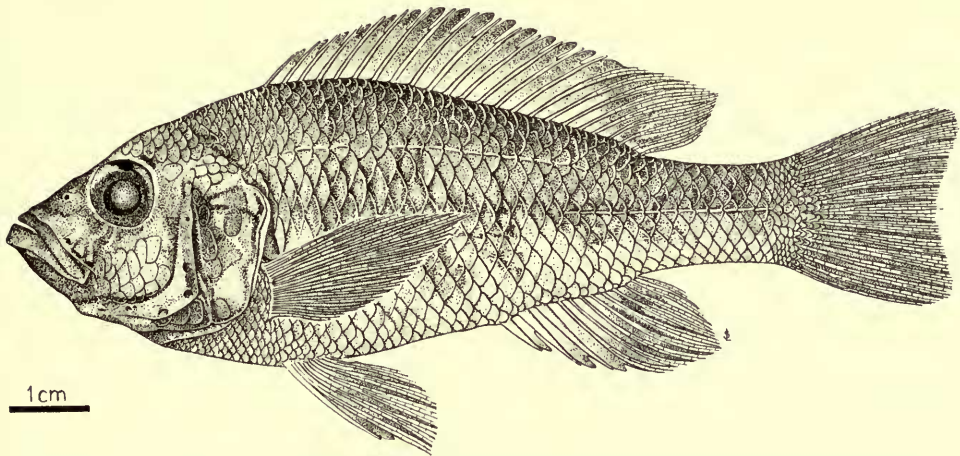


FIG. 35. *Haplochromis paraplagiostoma*. Holotype. Drawn by Sharon Lesure.

Caudal peduncle 17.6–20.4 ( $M = 19.0$ ) % of standard length, 1.5–1.8 (mode 1.6) times as long as deep.

Mouth slightly oblique, sloping at an angle of  $20^{\circ}$ – $35^{\circ}$ . Lower jaw projecting slightly, and with a distinct mental protuberance, its length 41.4–46.7 ( $M = 44.3$ ) % of head, 1.6–2.0 times as long as broad. Premaxilla not expanded anteromedially. Posterior tip of the maxilla reaching a vertical passing through the anterior part of the eye.

*Gill rakers*: Nine (mode) or 10 on the lower part of the first gill-arch, the lower 1 or 2 reduced, the upper 2–4 flattened and branched, the intervening rakers relatively slender.

*Scales*: ctenoid. Lateral line with 32 (f.2), 33 (f.4), 34 (f.1) or 35 (f.1) scales; cheek with 3 or 4 rows. Six to  $7\frac{1}{2}$  (mode 6) scales between the upper lateral line and the dorsal fin origin, 6 or 7 (mode) between the pectoral and pelvic fin bases.

*Fins*. Dorsal with 24 rays, comprising 15 spines and 9 branched rays. Anal with 11 (f.5) or 12 (f.3) rays, comprising 3 spines and 8 or 9 branched rays. Pectoral 24.5–28.0 ( $M = 26.7$ ) % of standard length. Caudal truncate, scaled on its proximal half to two-thirds. Pelvic fins with the first and second branched rays produced, the first more so, but without any sexual correlation.

*Teeth*. *Outer row*. In most specimens the outer teeth in both jaws are relatively compressed and unequally bicuspid, with a few weakly bicuspid and a few slender unicuspid interspersed amongst them. In the largest fish (98.0 mm. S.L.) unicuspid teeth predominate. Posteriorly in the *upper jaw* the teeth are smaller, and in some specimens are finer than the lateral and anterior teeth; unicuspid or weakly bicuspid teeth are usual in this region of the jaw. Teeth in the *lower jaw* are relatively stouter than those in the upper jaw, the discrepancy being most marked anteriorly and anterolaterally.

There are 60–72 ( $M = 64$ ) outer teeth in the upper jaw.

The *inner teeth* are all tricuspid, very obliquely implanted, and arranged in 2 rows in the upper jaw, and in 1 or 2 rows in the lower jaw.

*Osteology.* No complete skeleton is available. The *lower pharyngeal bone* is slender, with its triangular dentigerous surface slightly broader than long. The teeth are fine, compressed, and cuspidate and are arranged in about 30 rows.

*Coloration.* The colours of *live fishes* are unknown.

*Preserved material.* There is so little sexual dimorphism apparent in the preserved coloration of the sample available that a combined description of the sexes can be given.

The ground coloration is light pinkish-brown; scales on the dorsal aspects of the body, on the flanks and on the upper part of the belly have dark margins, thereby giving the whole body a faintly reticulate pattern. Scales along the midlateral line have broader dark margins, thus producing an ill-defined, sometimes interrupted longitudinal stripe from behind the operculum to the caudal fin origin. In some fishes there are very faint traces of 5-7 vertical bars on the flanks. The preorbital region of the head is dark, as is the interopercular region, the posterior margin of the preoperculum and at least part of the branchiostegal membrane; a faint lachrymal stripe is visible in all specimens.

The dorsal and anal fins are hyaline to greyish, the former with dark lappets. In males the anal fin has two indistinct ocelli, faintly outlined anteriorly in black. Caudal greyish, faintly maculate in some individuals. Pelvic fins dark in both sexes, but more uniformly so in males.

*Ecology.* All 8 specimens came from the same locality near Bulago island, over a mud bottom at a depth of 70 feet.

No information was obtained on the feeding habits of *H. paraplagiostoma*.

Some difficulty was experienced in determining the sexual state of several specimens; all except one (a ripening female, 93 mm. S.L.) could be either juvenile or quiescent.

*Diagnosis and affinities.* There is a certain superficial similarity between *H. paraplagiostoma* and *H. plagiostoma* (see Greenwood, 1962, p. 199), but the species differ in a number of characters, including the dentition. For example *H. paraplagiostoma* has a shorter head (31.9-33.4, M = 32% standard length, cf. 34.0-37.5, M = 36.0%), shallower cheek (25.1-29.0, M = 27.3% head, cf. 28.0-36.8, M = 33.0%), shallower preorbital (15.5-18.7, M = 17.1% head, cf. 18.0-21.5, M = 19.8%) and a shorter lower jaw (41.4-46.7, M = 44.3% head, cf. 44.0-54.5, M = 49.2%); the lower jaw of *H. paraplagiostoma* also slopes less steeply than that of *H. plagiostoma*.

The dentition differs in that the outer teeth of *H. plagiostoma* at all known lengths (69-147 mm. S.L.) are unicuspid, short, and strongly curved whereas in specimens of *H. paraplagiostoma* < 96 mm. S.L. the majority of teeth are distinctly and very unequally bicuspid, and are weakly curved. Unicuspid teeth are not frequent in fishes below 96 mm. S.L., and in the larger fish the unicuspid teeth differ in shape and relative size from those of *H. plagiostoma*.

There are clear-cut differences in the preserved coloration of the two species (cf. above and p. 201 of Greenwood, 1967).

Despite the superficial resemblances between *H. paraplagiostoma* and *H. plagiostoma*, we are not inclined to think that they indicate close relationship between the species.

Until more is known about *H. paraplagiostoma* the species cannot readily be linked with any of the known deep-water or inshore dwelling *Haplochromis* species. However, in many respects *H. paraplagiostoma* shows some affinity with the organizational level seen in *H. empodisma*. We do not imply that the species are closely related, but rather that *H. paraplagiostoma* could have evolved from a *H. empodisma*-like stem (see Greenwood, 1960).

#### STUDY MATERIAL AND DISTRIBUTION RECORDS

Museum and Reg. No.	Locality	Collector
	UGANDA	
B.M. (N.H.) 1968.8.30.127 (Holotype)	W. of Bulago isl. (70 feet)	E.A.F.F.R.O.
B.M. (N.H.) 1968.8.30.128-134	W. of Bulago isl. (70 feet)	E.A.F.F.R.O.

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#### APPENDIX

##### *Haplochromis obesus* (Blgr.) 1906

Six small fishes (67.0-71.0 mm. S.L.) caught at a depth of 80-90 feet over a mud substrate north of Nsadzi island, are tentatively identified as *H. obesus*. This species is otherwise known from littoral and immediately sublittoral habitats.

Our identification of these fishes is based on their peculiar dentition and their general facies, both of which are typical for *H. obesus* (see Greenwood, 1959). In most morphometric characters (see table below) the specimens agree with *H. obesus*, except for having a narrower interorbital (mean width 24.6% of head, cf. 32.2% in *H. obesus*) and a slightly longer caudal peduncle. Some of the Nsadzi fishes have a higher number of gill rakers (11) than is modal for *H. obesus* (9 or 10); however, a few *H. obesus* also have counts of 11, and one of the Nsadzi specimens has 10 gill rakers.

All six Nsadzi fishes (5 males, 1 female) are adult and sexually active. By contrast, the smallest known adult *H. obesus* from inshore and sublittoral populations is 85.0 mm. S.L. (Greenwood, 1959).

Another biological difference between the Nsadzi and the other populations concerns food. Three of the six Nsadzi fishes contained ingested material in the



stomach which, in each instance, is packed with Cladocera and Copepoda. The food of individuals from inshore habitats appears to be the embryos and larvae of fishes, especially Cichlidae (Greenwood, *op. cit.*). The significance of this dietary difference is impossible to assess. In neither instance are large numbers of gut analyses available (3 from Nsadzi, 18 from other habitats), and furthermore, all the Nsadzi fishes are smaller than any of the inshore fishes examined.

This marked size difference also hampers evaluation of the observed discrepancies in certain morphometric characters (see above); only one specimen of the Nsadzi sample falls within the size range of other *H. obesus* material.

Partly for this reason, and partly because we have so few deep-water specimens, we do not feel justified in creating a new species for the Nsadzi fishes.

The principal morphological characters of the Nsadzi specimens may be summarized as follows:

S.L.	D.*	H.*	Po. %	Io. %	Snt. %	Eye %	Ck. %	Lj. %	C.P.*
67.0	34.3	31.3	14.3	23.8	28.6	33.3	23.8	47.6	17.9
69.0	34.3	33.3	13.0	23.9	28.3	30.4	21.8	43.6	18.9
69.0	35.2	33.3	13.0	26.1	28.3	28.3	21.8	43.6	18.9
70.0	34.3	31.4	15.8	22.7	28.6	31.8	25.0	45.4	17.8
70.0	37.1	32.9	15.2	26.1	30.5	30.5	23.9	43.5	17.2
71.0	34.5	33.1	17.0	25.5	28.9	29.9	23.4	46.9	18.4

\* = % of standard length  
% = % of head

The lower jaw is 1.4-1.9 times as long as broad; the snout 1.3-1.6 times as broad as long. The caudal peduncle is 1.4-1.6 times as long as deep.

*Gill rakers*: short and stout, the upper 2 or 3 flattened and anvil-shaped; 10 (f.1) or 11 (f.5) on the lower part of the first gill arch.

*Teeth*. The *outer row* in the *upper jaw* is composed of 30-38 (M = 36), unicuspid or weakly bicuspid, slightly recurved teeth. In the *lower jaw*, the outer teeth are unicuspid (a few weakly bicuspid in one fish), with the tips of the anterior and anterolateral teeth directed outwards.

The *inner teeth* are tricuspid in the upper jaw, unicuspid in the lower, and are arranged in 1 or 2 rows.

*Fins*. Dorsal with 15 (f.3) or 16 (f.3) spines, and 8 or 9 branched rays. Pectoral 27.1-31.0 % of standard length.

*Scales*: ctenoid. Lateral line with 30 (f.2), 31 (f.2) or 32 (f.2) scales, cheek with 3 rows. Five and a half or 6½ scales between the dorsal fin origin and the upper lateral line, 6 between the pelvic and pectoral fin bases.

Register numbers: B.M. (N.H.) 1968.8.30.329; and 1968.9.3.3-7.

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